

ICSE 2025 EXAMINATION

Sample Question Paper - 1

Chemistry

Time Allowed: 2 hours

Maximum Marks: 80

General Instructions:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes.
- This time is to be spent reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- **Section A** is compulsory. Attempt any four questions from **Section B**.
- The intended marks for questions or parts of questions are given in brackets [].

Section A

1. **Question 1 Choose one correct answer to the questions from the given options:** [15]
- (a) Which of the following properties do not match with elements of the halogen family? [1]
- | | |
|----------------------------------------|-----------------------------------------------------|
| a) They are highly chemically reactive | b) They are diatomic in their molecular form |
| c) They are metallic in nature | d) They have seven electrons in their valence shell |
- (b) Which law is like the seven notes of music; sa, re, ga, ma, pa, _____? [1]
- | | |
|-------------------|-----------------------------------------|
| a) Law of triad | b) None of these |
| c) Law of octaves | d) Both Law of triad and Law of octaves |
- (c) When a metal atom becomes an ion: [1]
- | | |
|---------------------------------------|---------------------------------------|
| a) It loses electrons and is reduced | b) It loses electrons and is oxidised |
| c) It gains electrons and is oxidised | d) It gains electrons and is reduced |
- (d) A sample of soil is mixed with water and allowed to settle. The clean supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue? [1]
- | | |
|----------------|----------------|
| a) Vinegar | b) Antacid |
| c) Lemon juice | d) Common salt |
- (e) On diluting solution to pH of 4, its pH will [1]
- | | |
|----------------|--------------|
| a) remain same | b) decrease |
| c) increase | d) Can't say |
- (f) The salt solution which does not react with ammonium hydroxide is: [1]

- a) Calcium nitrate
b) Copper nitrate
c) Lead nitrate
d) Zinc nitrate

(g) A sample of Na_2CO_3 contains 6.02×10^{23} Na^+ ion. The mass of the sample is [Na = 23, C = 12, O = 16] **[1]**

a) 53 g
b) 106 gs
c) 212 g
d) 165 g

(h) How many moles of oxygen are produced by the decomposition of six moles of potassium chlorate? **[1]**
 $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2 \uparrow$

a) 12 moles
b) 9 moles
c) 3 moles
d) 6 moles

(i) Which of the following does not differentiate between electrochemical cell and electrolytic cell? **[1]**

i. Spontaneous or non-spontaneous nature of chemical process
ii. Chemical reactions occurring at the electrodes
iii. Positive or negative nature of anode
iv. None of these

a) Option (iii)
b) Option (i)
c) Option (ii)
d) Option (iv)

(j) The two main metals in bronze are: **[1]**

a) Copper and tin
b) Copper and zinc
c) Copper and lead
d) Copper and nickel

(k) Dilute sulphuric acid acts as: **[1]**

a) Typical acid
b) Least volatile acid
c) Drying agent
d) Dehydrating agent

(l) The ratio of ammonia and air taken in Ostwald's process is **[1]**

a) 1 : 3
b) 1 : 10
c) 10 : 1
d) 3 : 1

(m) Absolute alcohol can be obtained from rectified spirit by **[1]**

a) azeotropic distillation
b) vacuum distillation
c) fractional distillation
d) steam distillation

(n) Select the acid which contains four hydrogen atoms in it: **[1]**

a) Acetic acid
b) Sulphuric acid
c) Formic acid
d) Nitric acid

(o) When ethyl alcohol and acetic acid are mixed, the resulting ester has a chemical formula: **[1]**

a) $\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$
b) $\text{C}_2\text{H}_5\text{COOCH}_3$
c) $\text{CH}_3\text{COOCH}_3$
d) $\text{CH}_3\text{COOC}_2\text{H}_5$

2. Question 2

[25]

- (a) i. Nitrogen can be obtained in pure state by heating a mixture of ammonium chloride and a substance A. Name the substance A. [5]
- ii. A gas X reacts with another gas Y in the presence of catalyst Z to give a colourless gas C. The gas C on reacting with air produces a brown gas A. The solution of X in water turns red litmus to blue. Explain the observation.
- iii. Why nitrogen dioxide is called mixed anhydride?

- (b) Name the method used for preparation of the following salts from the list given below - [5]

Column I	Column II
(a) Sodium nitrate	(i) Simple displacement
(b) Iron (III) chloride	(ii) Neutralisation
(c) Lead chloride	(iii) Double decomposition
(d) Zinc sulphate	(iv) Direct synthesis

- (c) Complete the following by choosing the correct answers from the bracket:

- i. _____ are the longest periods, containing 32 elements each. [1]
- ii. Soluble salts are prepared by _____ whereas insoluble salts are generally prepared by _____. [1]
- iii. _____ is defined as the amount of substance which contains same number of units as the number of atoms in 12 g of carbon-12. [1]
- iv. Pure water consists almost entirely of _____ (ions/molecules). [1]
- v. Hydrogen chloride and water are examples of _____ (polar covalent compounds/non-polar covalent compounds) and a solution of hydrogen chloride in water _____ (contains/does not contain) free ions. [1]

- (d) Identify the following:

- i. The covalent compounds of carbon and hydrogen. [1]
- ii. A yellow non-metal formed when hydrogen sulphide gas is passed through concentrated nitric acid. [1]
- iii. The process of coating of iron with zinc. [1]
- iv. Ice like crystals formed on cooling an organic acid sufficiently. [1]
- v. Group 2 elements are called _____ metals. (alkali/alkaline) [1]

- (e) i. The volumes of gases A, B, C and D are in the ratio, 1 : 2 : 2 : 4 under the same conditions of temperature and pressure. [2]
- ii. i. Which sample of gas contains the maximum number of molecules?
- ii. If the temperature and the pressure of gas A are kept constant, then what will happen to the volume of A when the number of molecules is doubled?
- iii. If this ratio of gas volumes refers to the reactants and products of a reaction, which gas law is being observed?
- ii. An element A is placed on the left side of the periodic table with valency 2 and element B is placed on the right side of the periodic table with valency 3. [3]
- i. Write the equation to show how A and B form ions.

- ii. Which of the two elements will show reduction?
- iii. If B is a diatomic gas, write the equation for the direct combination of A and B to form a compound.

Section B

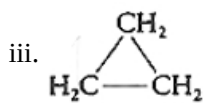
Attempt any 4 questions

3. **Question 3** [10]
- (a) Give the equations involved in brown ring test. [2]
 - (b) **Write the products and balance the equation.**
 - i. Zinc carbonate from Zinc sulphate. [1]
 - ii. Sodium sulphate using dilute sulphuric acid. [1]
 - (c) **Arrange the following as per the instruction given in the brackets:**
 - i. Na, K, Li (increasing chemical reactivity) [1]
 - ii. He, Ar, Ne (Increasing order of the number of shells) [1]
 - iii. Br, F, Cl [decreasing order of atomic radius] [1]
 - (d) **Fill in the blanks by selecting the appropriate word from the given choice:**
 - i. The carbon compounds containing _____ group are known as carbonylic acids. [1]
 - ii. A carbon atom linked with two carbon atoms is known as _____ carbon. [1]
 - iii. Complete the following, $n = \frac{\text{Molecular mass}}{\text{_____}}$ [1]
4. **Question 4** [10]
- (a) The non-polar and polar covalent compounds are generally formed between what kind of atoms? [2]
 - (b) Calculate the mass of calcium that will contain the same number of atoms as are present in 3.2 gm of sulphur. [2]
[Atomic masses: S = 32, Ca = 40]
 - (c) Answer the following questions with respect to the electrolytic process in the extraction of aluminium: [3]
 - i. Identify the components of the electrolyte other than pure alumina and the role played by each.
 - ii. Explain why powdered coke is sprinkled over the electrolytic mixture.
 - (d) **Explain the following:**
 - i. Zinc oxide can be reduced to zinc by using carbon monoxide, but aluminium oxide cannot be reduced by a reducing agent. [1]
 - ii. Anhydrous hydrogen chloride gas and anhydrous liquified hydrogen chloride are not acids. [1]
 - iii. Sodium chloride will conduct electricity only in fused or aqueous solution state. [1]
5. **Question 5** [10]
- (a) i. Write the IUPAC name of the given compounds: [1]

$$\begin{array}{c} \text{H} \\ | \\ \text{H} - \text{C} - \text{C} \equiv \text{C} - \text{H} \\ | \\ \text{H} \end{array}$$
 - ii. Draw the relevant structural formula for vinegar. [1]
 - (b) Draw the appropriate structural formula of carbon tetrachloride and state the type of bond present in it. [2]
 - (c) **Give balanced chemical equation for the following:**

- i. The oxidising action of conc. sulphuric acid on carbon [1]
 - ii. Action of concentrated sulphuric acid on carbon [1]
 - iii. Dilute hydrochloric acid on sodium sulphite [1]
- (d) **State one relevant observation for each of the following reactions:**
- i. Dilute hydrochloric acid is added to sodium carbonate crystals. [1]
 - ii. A mixture of ammonium chloride and sodium hydroxide is heated. [1]
 - iii. In the electrolyte during the electrolysis of copper sulphate solutions with inert electrodes. [1]

6. **Question 6** [10]

- (a)
- i. Why do group 1 elements form unipositive ions? [2]
 - ii. Why do all elements in a group have similar properties?
- (b) Find the empirical formulae of the compounds with the following percentage compositions, [2]
- i. Zn = 47.8
 - ii. Cl = 52.2
- (c) Write the name and structure of at least one isomer in each of the following. [3]
- i. H_3COCH_3
 - ii. $\text{H}_3\text{C}-\text{CO}-\text{CH}_3$
 - iii. 
- (d) Write the product of the following reactions. [3]
- i. $\text{Ca}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow$
 - ii. $\text{FeSO}_4 + \text{NaOH} \rightarrow$
 - iii. $\text{FeCl}_3 + 3\text{NaOH} \rightarrow$
 - iv. $\text{CuSO}_4 + \text{NaOH} \rightarrow$
 - v. $\text{ZnSO}_4 + \text{NaOH} \rightarrow$
 - vi. $\text{Pb}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow$

7. **Question 7** [10]

- (a)
- i. What do you understand by a lone pair of electrons? [2]
 - ii. Draw the electron dot diagram of Hydronium ion. (H = 1, O = 8)
- (b) A gas cylinder contains 24×10^{24} molecules of nitrogen gas. If Avogadro's number is 6×10^{23} and the relative mass of nitrogen is 14, calculate: [2]
- i. mass of nitrogen as in the cylinder
 - ii. volume of nitrogen at STP in dm^3
- (c) Name the kind of particle present in [3]
- i. sodium hydroxide solution
 - ii. carbonic acid
 - iii. sugar solution
- (d) Give a laboratory preparation of [3]
- i. ethyl alcohol
 - ii. methyl alcohol

8. **Question 8** [10]
- (a) i. The metals of group 2 from top to bottom are: Be, Mg, Ca, Sr, Ba. Which of these metals will form ions most readily and why? [2]
ii. What property of an element is measured by electronegativity?
- (b) Calculate the mass of: [2]
i. 10^{22} atoms of sulphur
ii. 0.1 mole of carbon dioxide.
- (c) A is a soluble acidic oxide and B is a water soluble base. What should be the pH of [3]
i. aqueous solution of A?
ii. aqueous solution of B?
iii. distilled water?
- (d) i. How would you separate: Gold from a mixture of gold and copper filings? [3]
ii. Name a nitrate of a metal which on heating does not give nitrogen dioxide.
iii. Name all the products formed when: ammonium nitrate is heated.

Solution

Section A

1. Question 1 Choose one correct answer to the questions from the given options:

- (i) (c) They are metallic in nature

Explanation: {

They are metallic in nature

- (ii) (c) Law of octaves

Explanation: {

Law of octaves

- (iii) (b) It loses electrons and is oxidised

Explanation: {

It loses electrons and is oxidised

- (iv) (b) Antacid

Explanation: {

Antacid

- (v) (c) increase

Explanation: {

Given, pH = 4

On dilution, the concentration of H^+ ions decreases, that results in increase in the pH value, as $pH = -\log[H^+]$

- (vi) (a) Calcium nitrate

Explanation: {

Calcium nitrate

- (vii) (a) 53 g

Explanation: {

Each Na_2CO_3 contain $2 \times N_A$ Na^+ ion ($N_A = 6.02 \times 10^{23}$)

\therefore When we have $2 \times N_A$ of Na^+ ions,

we have 1 mole of Na_2CO_3 i.e., 106 g of Na_2CO_3

(Molar mass (M) = 106)

Hence, when we have N_A ions of Na^+ , the mass of

$$Na_2CO_3 = \frac{M}{2} = \frac{106}{2} = 53 \text{ g}$$

- (viii) (b) 9 moles

Explanation: {

9 moles

- (ix) (c) Option (ii)

Explanation: {

Oxidation always occurs at anode and reduction always occurs at cathode.

Thus, we can not differentiate an electrochemical cell and an electrolytes cell by chemical reactions occurring at electrodes.

- (x) (a) Copper and tin

Explanation: {

Copper and tin

- (xi) (a) Typical acid

Explanation: {

Typical acid

(xii) (b) 1 : 10

Explanation: {

1 : 10

(xiii) (a) azeotropic distillation

Explanation: {

Absolute alcohol is named to 100% concentrated ethanol with chemical formula C_2H_5OH . To obtain absolute alcohol from rectified spirit (95% ethanol + 5% water) azeotropic distillation is used.

(xiv) (a) Acetic acid

Explanation: {

Acetic acid

(xv) (d) $CH_3COOC_2H_5$

Explanation: {

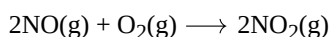
$CH_3COOC_2H_5$

2. Question 2

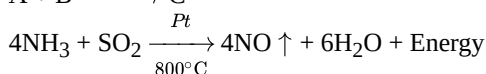
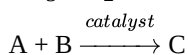
(i) i. The substance A = Sodium nitrate

ii. $A + B \xrightarrow{\text{catalyst}} C$

The gas C when comes in contact with air (O_2) a brown gas D is produced which is due to nitrogen dioxide (NO_2), hence, C is NO.



The solution of A in water turns red litmus blue, hence it is a base i.e., NH_4OH .



iii. Nitrogen dioxide called mixed anhydrous because it dissolves in water forming two acids i.e., nitrous acid (HNO_2) and nitric acid (HNO_3).

(ii) (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

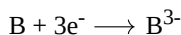
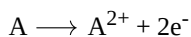
(iii) Complete the following by choosing the correct answers from the bracket:

- i. 1. Sixth and seventh
2. 6 and 7
3. 6, 7
4. 7, 6
- ii. 1. neutralisation, precipitation reactions
- iii. 1. Mole
- iv. 1. molecules
- v. 1. Polar covalent compounds, contains

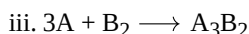
(iv) Identify the following:

- i. 1. Hydrocarbons
- ii. 1. Sulphur
- iii. 1. Galvanization
- iv. 1. Glacial acetic acid
- v. 1. alkaline

- (v) i. i. Sample of gas D contains the maximum number of molecules.
ii. When the number of molecules is doubled then the volume of the gas A will get doubled.
iii. Gay Lussac's law of combining volumes.
- ii. i. Elements placed on the left side of the periodic table are electropositive (metals) and hence, will lose electrons for stability. Elements present on the right side are electronegative and will gain an electron for stability.

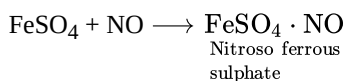
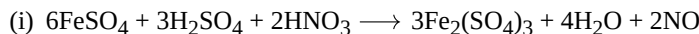


ii. Element B will show reduction.

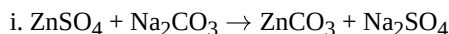


Section B

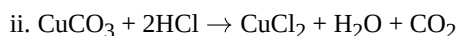
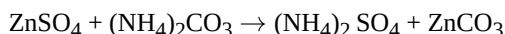
3. Question 3



(ii) Write the products and balance the equation.



or



(iii) Arrange the following as per the instruction given in the brackets:

i. $Li < Na < K$

ii. $He < Ne < Ar$

iii. Decreasing order of atomic radius $Br > Cl > F$

(iv) Fill in the blanks by selecting the appropriate word from the given choice:

i. 1. carbonyl ($-COOH$)

ii. 1. Catenation

iii. 1. Empirical formula mass

4. Question 4

(i) **Non-polar covalent bonds** These type of bonds are generally formed between

i. similar atoms such as in H_2 , O_2 , N_2 , F_2 , etc.

ii. atoms having negligible or zero electronegativity difference e.g., CH_4 .

Polar covalent bonds These type of bonds are generally formed between

i. dissimilar atoms such H_2O , NH_3 .

ii. atoms having different electronegativities and atomic radii, such as in HCl , HF , etc.

(ii) 32 gm of sulphur contains 6.023×10^{23} atoms

$$3.2 \text{ gm of sulphur contains} = \frac{6.023 \cdot 10^{23} \cdot 3.2}{32 \cdot 10}$$

$$= 6.023 \times 10^{23} \text{ atoms}$$

6.023×10^{23} atoms are present in 40 gm of calcium

$$6.023 \times 10^{23} \text{ atoms are present in} = \frac{6.023 \times 10^{22} \times 40}{6.023 \times 10^{23} \times 10}$$

$$= 4 \text{ gm.}$$

(iii) i. **Cryolite** - lowers the fusion temperature of the electrolyte.

Fluorspar - increases the conductivity of the electrolyte or acts as a solvent.

ii. to prevent the heat loss from the electrolyte.

(iv) Explain the following:

i. This is because of the fact that aluminium has great affinity towards oxygen and so, it cannot be reduced by reducing agents such as carbon monoxide, carbon or hydrogen.

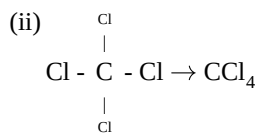
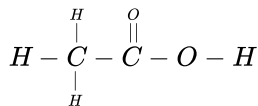
ii. This is because neither of them forms hydrogen ions or hydronium ions (H_3O^+) due to the absence of water molecules.

iii. Na^+ and Cl^- ions become mobile only on melting or dissolving it in water and only then can $NaCl$ conduct electricity.

5. Question 5

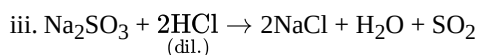
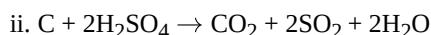
(i) i. Propyne

ii. Vinegar (CH_3COOH acetic acid)



4 - single covalent bonds

(iii) Give balanced chemical equation for the following:



(iv) State one relevant observation for each of the following reactions:

- Brisk effervescence with the evolution of a colourless, odourless gas which when passed through lime water, it turns milky.
- Ammonia gas, sodium chloride and water is formed/Ammoniacal smell.
- The colour of the electrolyte fades i.e., from blue it changes to colourless.

6. Question 6

- Group 1 elements contain one electron in their outermost shell. These elements lose this electron easily to attain the octet (8 electrons) in their outermost shell. Hence, they form unipositive ion.
- All the elements in a group have similar properties because they have identical valence shell electronic configuration.

(ii)

Element	Percentage Composition	Atomic Weight	Atomic Ratio	Simplest Ratio
Zn	47.8	65	$\frac{47.8}{65} = 0.73$	$\frac{0.73}{0.73} = 1$
Cl	52.2	35.5	$\frac{52.2}{35.5} = 1.46$	$\frac{1.46}{0.73} = 2$

Thus, the ratio of Zn : Cl atoms = 1 : 2. The empirical formula of the compound is ZnCl_2 .

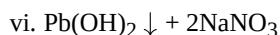
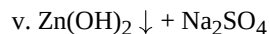
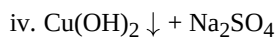
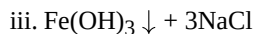
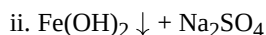
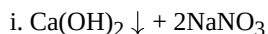
(iii) The name and structure of at least one isomer in each of the following:

i. $\text{C}_2\text{H}_5\text{OH}$: Ethyl alcohol

ii. $\text{C}_2\text{H}_5\text{CHO}$: Propanal

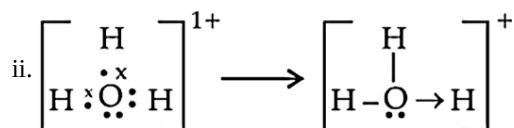
iii. $\text{H}_3\text{C}-\text{CH}=\text{CH}_2$: Propene

(iv) The products of given reactions are follows:



7. Question 7

- The pair of electrons which is not yet shared with other atoms in a covalent molecule is known as lone pair of electrons.



- i. 6×10^{23} molecules of nitrogen weights = $2 \times 14 = 28$ g

$\therefore 24 \times 10^{24}$ molecules of nitrogen weights = $\frac{28 \times 24 \times 10^{24}}{6 \times 10^{23}}$

= 1120 g

ii. Volume of nitrogen gas at STP

6×10^{23} molecules of N_2 occupy 22.4 L at STP

$$24 \times 10^{24} \text{ molecules of } N_2 \text{ occupy} = \frac{22.4 \times 24 \times 10^{24}}{6 \times 10^{23}} \\ = 896 \text{ L}$$

(iii) i. Sodium hydroxide solution is a strong electrolyte. So the kind of particle present in sodium hydroxide solution are ions only.

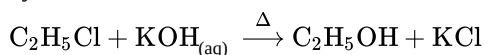
i.e., Na^+ and OH^- ion.



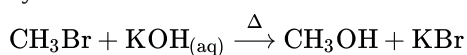
ii. Carbonic acid is weak electrolyte, so the kind of particles present in weak electrolyte are ions and unionised molecules.

iii. Sugar particles present in sugar solution are molecules only.

(iv) i. **Laboratory preparation of ethyl alcohol:** By hydrolysis of C_2H_5Cl (ethyl chloride) with hot aqueous potassium hydroxide solution.



ii. **Laboratory preparation of methyl alcohol:** By hydrolysis of methyl bromide with hot aqueous potassium hydroxide solution.



8. Question 8

(i) i. Ba will form ions most readily. Because it's ionisation potential is lowest in the group.

ii. Ability of the element to attract the shared pair of electron in a covalent bond towards itself.

(ii) i. 6×10^{23} atoms of sulphur = 32 g

$$10^{22} \text{ atoms of sulphur} = \frac{32}{6 \times 10^{23}} \times 10^{22} = 0.533 \text{ g}$$

ii. Molar mass of $CO_2 = 12 + 2 \times 16 = 44\text{g}$

1 mole of CO_2 weights = 44 g

0.1 mole of CO_2 weights = $44 \times 0.1 = 4.4 \text{ g}$

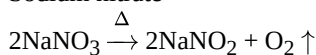
(iii) i. $A + \text{Water} \longrightarrow \text{Acid}$, hence, pH of $A < 7$.

ii. B is a water-soluble base, hence, pH of $B > 7$.

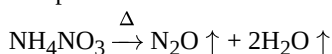
iii. Distilled water is neutral (pH = 7).

(iv) i. A mixture of gold and copper filings is treated with concentrated nitric acid. Copper reacts with cone. HNO_3 to form blue solution of copper nitrate while gold does not react. Now, it is separated by filtration.

ii. Sodium nitrate



iii. The products formed when ammonium nitrate is heated are nitrous oxide and water (steam).



ICSE 2025 EXAMINATION

Sample Question Paper - 2

Chemistry

Time Allowed: 2 hours

Maximum Marks: 80

General Instructions:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes.
- This time is to be spent reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- **Section A** is compulsory. Attempt any four questions from **Section B**.
- The intended marks for questions or parts of questions are given in brackets [].

Section A

1. **Question 1 Choose one correct answer to the questions from the given options:** [15]

(a) The element with the highest ionisation potential in the periodic table is _____. [1]

a) He

b) Xe

c) Ar

d) Ne

(b) The electronegativity on moving from left to right in a period [1]

a) decreases

b) depends on the number of valence electrons

c) increases

d) remains the same

(c) The electronic configurations of four elements [1]

L : $1s^2 2s^2 2p^4$

Q : $1s^2 2s^2 2p^6 3s^2 3p^5$

P : $1s^2 2s^2 2p^6 3s^1$

R : $1s^2 2s^2 2p^6 3s^2$

The formulae of ionic compounds that can be formed between them are

a) LP, R₂L, P₂Q, RQ

b) L₂P, RL, PQ, R₂Q

c) P₂L, RL, PO, RQ₂

d) LP, RL, PQ, RQ

(d) If few drops of a concentrated acid accidentally spills over the hand of a student, what should be done? [1]

a) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate

b) After washing with plenty of water apply solution of sodium hydroxide on the hand

- c) Wash the hand with saline solution d) Neutralise the acid with a strong alkali
- (e) Aqua regia is a mixture of: [1]
- a) concentrated hydrochloric acid and dilute nitric acid b) dilute hydrochloric acid and concentrated nitric acid
- c) concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part) d) concentrated hydrochloric acid (1 part) and concentrated nitric acid (3 parts)
- (f) Hydroxide of this metal is soluble in sodium hydroxide solution: [1]
- a) Silver b) Copper
- c) Magnesium d) Lead
- (g) The element which has two atoms in its molecule is [1]
- a) ozone b) phosphorus
- c) oxygen d) helium
- (h) What will be the empirical formula of CH_3COOH ? [1]
- a) CHO_2 b) $\text{C}_2\text{H}_2\text{O}_2$
- c) CH_2O d) C_2HO
- (i) The particles present in strong electrolytes are: [1]
- a) only molecules b) only atoms
- c) mainly ions d) ions and molecules
- (j) What does 22 carat gold means? [1]
- a) 22 parts gold mixed with 2 parts of Cu or Ag b) 22 parts gold mixed with 3 parts of Zn
- c) 22 parts of gold only d) 22 parts gold mixed with 2 parts of Al
- (k) $\text{NH}_4\text{Cl(s)}$ is heated in a test tube. Vapours are brought in contact with red litmus paper, which changes to blue and then to red. It is because of [1]
- a) greater diffusion of HCl than NH_3 b) formation of NH_4OH and HCl
- c) greater diffusion of NH_3 than HCl d) formation of NH_3 and HCl
- (l) Select the pair of gases which turn lime water milky: [1]
- a) CO_2 and NH_3 b) SO_2 and SO_3
- c) CO_2 and SO_3 d) SO_2 and CO_2
- (m) Which of the following reactions will not produce ethane? [1]
- a) Reduction of CH_3COOH with HI/P_4 b) Reduction of CH_3COCH_3 with HI/P_4
- c) Sodalime decarboxylation of sodium propionate d) Hydrogenation of ethane in the presence of Ni
- (n) The functional group present in acetic acid is: [1]

a) Hydroxyl -OH

b) Carboxyl -COOH

c) Ketonic >C=O

d) Aldehydic -CHO

(o) What will be the final oxidation product of ethyl alcohol?

[1]

a) Acetaldehyde

b) Acetone

c) Acetalhyde

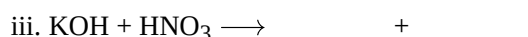
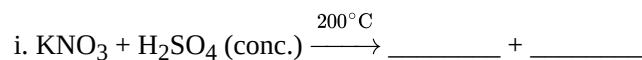
d) Acetic acid

2. Question 2

[25]

(a) Complete and balance the following equations.

[5]



(b) Match the gases given in column I to the identification of the gases mentioned in column II.

[5]

Column I	Column II
(a) Hydrogen sulphide	(i) Turns acidified potassium dichromate solution green
(b) Nitric oxide	(ii) Turns lime water milky
(c) Carbon dioxide	(iii) Turns reddish brown when it reacts with oxygen
(d) Sulphur dioxide	(iv) Turns moist lead acetate paper silvery black

(c) Complete the following by choosing the correct answers from the bracket:

i. The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called _____. (electron affinity/ionisation potential/electronegativity) [1]

ii. Soluble salts are prepared by _____ whereas insoluble salts are generally prepared by _____. [1]

iii. The number of moles in 11 gm of nitrogen gas is _____. (0.39/0.49/0.29) [1]
[Atomic mass of N = 14]

iv. _____ the concentration of an ion in a solution, the greater is the probability of its being discharged at its appropriate electrode. [1]

v. Quicklime is not used to dry HCl gas because _____. (CaO is alkaline/CaO is acidic/CaO is neutral). [1]

(d) Identify the following:

i. The property by which carbon compounds with itself to form a long chain. [1]

ii. The gas evolved when hydrochloric acid is added to manganese(IV) oxide. [1]

iii. The electrolytic deposition of a superior metal on a base plate. [1]

iv. The base which is soluble in water. [1]

v. The properties of the elements are a periodic function of their _____. (atomic number/mass number/relative atomic mass) [1]

- (e) i. i. State the volume occupied by 40 gm of methane at STP, if its vapour density (V.D.) is 8. [2]
 ii. Calculate the number of moles present in 160 gm of NaOH.
 [Atomic mass: Na = 23, H = 1, O = 16].
- ii. Elements X, Y and Z have atomic number 6, 9 and 12 respectively. Which: [3]
 i. forms an anion?
 ii. forms a cation?
 iii. has four electrons in its valence shell?

Section B

Attempt any 4 questions

3. **Question 3** [10]
- (a) State one chemical test to distinguish between each of the following pairs - [2]
 Manganese dioxide and Copper (II) oxide.
- (b) **Write the products and balance the equation.**
 i. Sodium sulphate using dilute sulphuric acid. [1]
 ii. Ammonium sulphate crystals. [1]
- (c) **Arrange the following as per the instruction given in the brackets:**
 i. Cs, Na, Li, K, Rb (increasing order of metallic character) [1]
 ii. F, B, N, O (In the increasing order of electron affinity) [1]
 iii. K, Pb, Ca, Zn (In the increasing order of the reactivity) [1]
- (d) **Fill in the blanks by selecting the appropriate word from the given choice:**
 i. _____ is also known as wood spirit. (methanol/ethanol/propanol). [1]
 ii. _____ was the first organic compound prepared in laboratory. [1]
 iii. CH_2O is an _____ for the molecular formula, $\text{C}_6\text{H}_{12}\text{O}_6$. [1]
4. **Question 4** [10]
- (a) Explain the bonding in methane molecule using electron dot structure. [2]
- (b) Calculate the volume of 320 g of SO_2 at STP. [2]
 [Atomic mass of S = 32 and O = 16]
- (c) Bayer's process is used to concentrate bauxite to alumina. Give balanced chemical equations for the reaction taking place for its conversion from bauxite to alumina. [3]
- (d) **Explain the following:**
 i. Aluminium is more abundant than gold in the earth's crust, yet it is gold and not aluminium that has been known to man since ancient times. [1]
 ii. Zinc chloride is stored in air-tight bottles. [1]
 iii. An aqueous solution of sodium chloride conducts electricity. [1]
5. **Question 5** [10]
- (a) i. What are the main types (groups) of aliphatic hydrocarbons? [1]
 ii. Define Homologous series [1]
- (b) Explain, polar covalent bond with the help of suitable example. [2]
- (c) **Give balanced chemical equation for the following:**
 i. Lead nitrate is heated in a dry test tube [1]

- ii. Magnesium sulphate solution is mixed with barium chloride solution [1]
- iii. Action of dilute sulphuric acid on sodium sulphite [1]
- (d) **State one relevant observation for each of the following reactions:**
- i. Barium chloride solution is slowly added to sodium sulphate solution. [1]
- ii. Ammonium hydroxide solution is added to copper (II) nitrate solution in small quantities and then in excess. [1]
- iii. In the electrolyte during the electrolysis of copper sulphate solutions with inert electrodes. [1]

6. **Question 6** [10]

- (a) An element Z has atomic number 16. Answer the following questions. [2]
 - i. State the period and group to which Z belongs.
 - ii. Is Z a metal or a non-metal?
- (b) Find the number of moles and molecules present in 7.1 g of Cl_2 . (At. Wt. Cl = 35.5) [2]
- (c) Give the common name of [3]
 - i. ethanol
 - ii. ethoxyethane
 - iii. ethanoic acid
- (d) Distinguish between the following pairs of compounds using the test given within the brackets. [3]
 - i. Calcium sulphite and calcium carbonate (using dil. HCl).
 - ii. Calcium nitrate and potassium nitrate (using a flame test).
 - iii. Lead nitrate solution and Zinc nitrate solution (using an alkali).

7. **Question 7** [10]

- (a) What is the essential difference in the nature of compounds when two combining atoms? [2]
 - i. differ much in their electronegativities?
 - ii. don't differ much in their electronegativities?
- (b) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound. [2]
- (c) Identify the following reactions as either oxidation or reduction. [3]
 - i. $\text{O} + 2e^- \longrightarrow \text{O}^{2-}$
 - ii. $\text{K} \longrightarrow \text{K}^+ + e^-$
 - iii. $\text{Fe}^{3+} + e^- \longrightarrow \text{Fe}^{2+}$
- (d) Write the IUPAC name of the following compounds: [3]
 - i. Ethyl alcohol
 - ii. Formaldehyde
 - iii. Acetaldehyde
 - iv. Acetic acid

8. **Question 8** [10]

- (a) Show the formation of covalent bonds in [2]
 - i. oxygen
 - ii. nitrogen molecule by dot diagram.
- (b) If 6 litres of hydrogen and 4 litres of chlorine are mixed and exploded and if water is added to the [2]

gases formed, find the volume of the residual gas.

- (c) A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, a gas G that is obtained at anode during the electrolysis of brine and when passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G and Z. [3]
- (d) List the properties of ammonia that make it: [3]
- i. A good refrigerant
 - ii. A cleaning agent
 - iii. As a source of hydrogen

Solution

Section A

1. Question 1 Choose one correct answer to the questions from the given options:

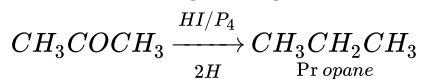
- (i) **(a)** He
Explanation: {
He
- (ii) **(c)** increases
Explanation: {
increases
- (iii) **(c)** P_2L , RL , PO , RQ_2
Explanation: {
Given, L has \rightarrow 6 valence electrons
Q has \rightarrow 7 valence electrons
P has \rightarrow 1 valence electron
R has \rightarrow 2 valence electrons
Thus, the ionic compounds formed between them are P_2L , RL , PQ and RQ_2 .
- (iv) **(a)** Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate
Explanation: {
Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate
- (v) **(c)** concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part)
Explanation: {
concentrated hydrochloric acid (3 parts) and concentrated nitric acid (1 part).
- (vi) **(d)** Lead
Explanation: {
Lead hydroxide $Pb(OH)_2$ is soluble in excess of sodium hydroxide solution.
- (vii) **(c)** oxygen
Explanation: {
 O_2 (oxygen)
- (viii) **(c)** CH_2O
Explanation: {
 CH_2O
- (ix) **(c)** mainly ions
Explanation: {
mainly ions
- (x) **(a)** 22 parts gold mixed with 2 parts of Cu or Ag
Explanation: {
22 parts gold mixed with 2 parts of Cu or Ag
- (xi) **(c)** greater diffusion of NH_3 than HCl
Explanation: {
Ammonium chloride decomposes to form ammonia and hydrogen chloride gas. Ammonia diffuses faster than hydrogen chloride because its light. Ammonia is basic and thus red litmus paper turns blue, while hydrogen chloride is acid, thus blue litmus turns red.
- (xii) **(d)** SO_2 and CO_2
Explanation: {

SO₂ and CO₂

(xiii) **(b)** Reduction of CH₃COCH₃ with HI/P₄

Explanation: {

Reduction of CH₃COCH₃ with HI/P₄ does not product ethane. It produce propane with HI/P₄.



(xiv) **(b)** Carboxyl -COOH

Explanation: {

Carboxyl -COOH

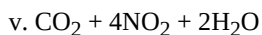
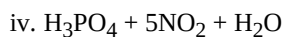
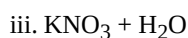
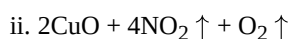
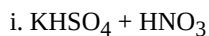
(xv) **(d)** Acetic acid

Explanation: {

Acetic acid

2. Question 2

(i) Complete reaction are as follows:



(ii) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

(iii) Complete the following by choosing the correct answers from the bracket:

i. 1. ionisation potential

ii. 1. neutralisation, precipitation reactions

iii. 1. 0.39

iv. 1. higher

v. 1. CaO is alkaline

(iv) Identify the following:

i. 1. Catenation

ii. 1. Chlorine

iii. 1. Electroplating

iv. 1. Alkali

v. 1. atomic number

(v) i. i. Molecular mass of methane (CH₄)

$$= 12 + 1 \times 4$$

$$= 16 \text{ gm}$$

$$\text{Mass of methane} = 40$$

$$M = V.D. \times 2$$

$$= 8 \times 2$$

$$= 16 \text{ gm}$$

$$\text{Volume of 16 gm of CH}_4 \text{ at STP}$$

$$= 22.41$$

$$\text{Volume of 40 gm of CH}_4 \text{ at STP}$$

$$= \frac{22.4 \times 10}{16}$$

$$= 56 \text{ l}$$

ii. Mass of the NaOH = 160 gm

$$\text{Molecular mass of NaOH} = 23 + 16 + 1$$

$$= 40$$

$$\text{Number of moles} = \frac{\text{Mass of the substance}}{\text{Molecular mass}}$$

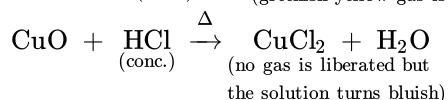
$$= \frac{160}{40} = 4 \text{ moles}$$

- ii. i. Y forms an anion.
- ii. Z forms a cation.
- iii. X has four electrons in its valence shell.

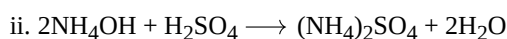
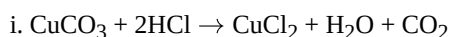
Section B

3. Question 3

- (i) To both the compounds add. conc. HCl and heat, the following observations help:



- (ii) Write the products and balance the equation.



- (iii) Arrange the following as per the instruction given in the brackets:

i. $\text{Li} < \text{Na} < \text{K} < \text{Rb} < \text{Cs}$ (increasing order)

ii. B, N, O, F

iii. Pb, Zn, Ca, K

- (iv) Fill in the blanks by selecting the appropriate word from the given choice:

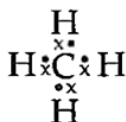
i. 1. methanol

ii. 1. Urea

iii. 1. empirical formula

4. Question 4

- (i) To attain the stable electronic configuration of the nearest noble gas, carbon needs four electrons and hydrogen needs one electron. Therefore, in the methane molecule formation of one atom of carbon shares four electron pairs, one with each of the four atoms of hydrogen. It results in the formation of four single covalent bond between them. The electron sharing can be illustrated using electron dot structure which is as follows:



- (ii) Molecular mass of $\text{SO}_2 = 32 + 2 \times 16$

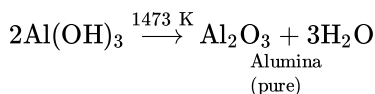
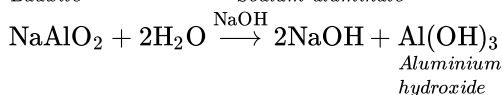
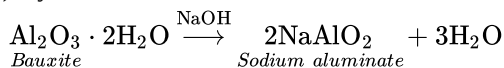
$$= 64 \text{ amu}$$

Since 64 g of SO_2 occupies at 22.4 litres at STP

$$320 \text{ g of } \text{SO}_2 \text{ occupies at 22.4 litres at STP} = \frac{320 \times 22.4}{64}$$

$$= 112 \text{ litres}$$

- (iii) Bayer's method for extraction of alumina from bauxite ore.



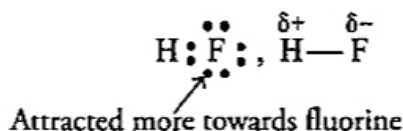
- (iv) Explain the following:

- i. This is due to the fact that aluminium never occurs in the free state in nature. It is always chemically combined with other elements. This is because of its high reactivity. The ores of aluminium are also very stable and cannot be reduced by coke. On the other hand, gold is a noble metal. It is available in the free state or native form because of its unreactive nature.

- ii. Zinc chloride is a deliquescent substance. It absorbs moisture from the atmosphere and turns into solution. In order to prevent this, it is stored in air tight bottles.
- iii. Aqueous solution of sodium contains mobile ions like Na^+ , Cl^- , H^+ , OH^- , H_3O^+ ions which are responsible for conduction of electricity.

5. Question 5

- (i)
 - i. Saturated aliphatic hydrocarbons e.g., Methane and ethane.
 - ii. Unsaturated aliphatic hydrocarbons e.g., Ethene and ethyne.
- ii. A homologous series is a group of organic compounds having similar structure and similar chemical properties in which the successive compounds differ by CH_2 groups.
- (ii) When covalent bond is formed between two dissimilar atoms e.g., HF (heteronuclear molecule), the shared pair of electrons between the two atoms get displaced towards more electronegative atom, fluorine. As a result, hydrogen atom becomes slightly positively charged and fluorine becomes slightly negatively charged. This type of bond is called polar covalent bond.



- (iii) Give balanced chemical equation for the following:

- i. $2\text{Pb}(\text{NO}_3)_2 \xrightarrow{\Delta} 2\text{PbO} + 4\text{NO}_2 \uparrow + \text{O}_2 \uparrow$
- ii. $\text{MgSO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 \downarrow + \text{MgCl}_2$
- iii. $\text{Na}_2\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{SO}_2 \uparrow$

- (iv) State one relevant observation for each of the following reactions:

- i. When barium chloride solution white precipitate of is slowly added to sodium sulphate solution, then white precipitate of barium sulphate is formed.
 $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaCl}(\text{aq})$
- ii. Initially a Bluish white ppt. is formed which on addition of excess of ammonium hydroxide dissolves and a deep inky blue solution is formed.
- iii. The colour of the electrolyte fades i.e., from blue it changes to colourless.

6. Question 6

- (i)
 - i. Atomic number of element, $Z = 16$
 Electronic configuration $\begin{array}{ccc} K & L & M \\ 2 & 8 & 6 \end{array}$
 Number of shells is 3, (i.e., K, L, M). So, period is 3.
 Group number VIA
 - ii. Z is non-metal. Since, non-metals usually have 5, 6 or 7 electrons in their outermost orbits.

- (ii) Molecular mass of $\text{Cl}_2 = 2 \times 35.5 = 71$

$$\text{No. of moles} = \frac{\text{Mass of substance}}{\text{Mass of one mole}}$$

$$= \frac{7.1}{71} = 0.1 \text{ moles of } \text{Cl}_2$$

$$71 \text{ g of chlorine has } 6.023 \times 10^{23} \text{ molecules}$$

$$7.1 \text{ g of chlorine will have } = \frac{6.023 \times 10^{23}}{71} \times 7.1$$

$$= 6.023 \times 10^{22} \text{ molecules}$$

- (iii)
 - i. The common name of ethnlol - ethyl alcohol
 - ii. The common name of ethoxyethane - diethyl ether
 - iii. The common name of ethanoic acid - acetic acid

(iv) i.	Substance	Test	Gas evolved	Odour
	Calcium carbonate	Using dil. HCl	CO_2	Odourless
	Calcium sulphite		SO_2	Pungent

ii.	Substance	Test	Flame Colour
	Calcium nitrate	Using Flame Test	Deep orange
	Potassium nitrate		Pink/Purple
iii.	Substance	NH ₄ OH in excess	
	Lead nitrate solution	Precipitate formed is insoluble.	
	Zinc nitrate solution	Precipitate formed is soluble.	

7. Question 7

- (i) i. Form either ionic bond or polar covalent bond.
ii. Form non-polar covalent bond.

(ii) Empirical formula of a compound = CH

$$\text{Empirical formula mass} = 12 + 1 = 13 \text{ g}$$

$$\text{Molecular formula mass} = 2 \times \text{Vapour density}$$

$$= 2 \times 13 = 26 \text{ g}$$

$$n = \frac{26}{13} = 2$$

$$\text{Molecular formula} = (\text{Empirical formula})_n$$

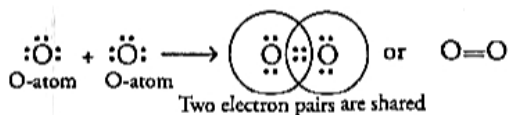
$$\therefore \text{Molecular formula} = (\text{CH})_2 = \text{C}_2\text{H}_2$$

- (iii) i. $\text{O} + 2e^- \longrightarrow \text{O}^{2-}$ - Reduction
ii. $\text{K} \longrightarrow \text{K}^+ + e^-$ - Oxidation
iii. $\text{Fe}^{3+} + e^- \longrightarrow \text{Fe}^{2+}$ - Reduction

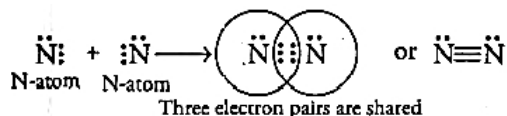
- (iv) i. Ethanol
ii. Methanal
iii. Ethanal
iv. Ethanoic acid

8. Question 8

- (i) i. Oxygen



- ii. Nitrogen

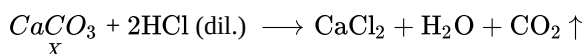


- (ii) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
1 vol. 1 vol. 2 vols.

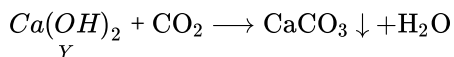
Since, 1 volume of chlorine reacts with 1 litres of hydrogen.

\therefore 4 litres of chlorine will react with only 4 volumes of hydrogen. 6 litres of H_2 provided, out of which 4 litres of H_2 used. HCl gas is highly soluble in water. Unused H_2 will be $6 - 4 = 2$ litres. Therefore, residual gas will be unreacted chlorine = $(6 - 4) = 2$ litres.

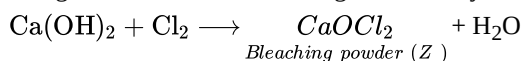
- (iii) X is calcium carbonate (CaCO_3) and the gas evolved is carbon dioxide (CO_2), when calcium carbonate reacts with acid, calcium chloride (CaCl_2) is formed.



Solution Y is lime water Ca(OH)_2 because, when CO_2 is passed through it, it gives the carbonate back as shown by the given equation.



The gas evolved at anode during the electrolysis of brine is chlorine (Cl_2).



- (iv) i. Ammonia can be liquefied easily and has a high latent heat of vaporisation.

- ii. This is because ammonia solution emulsifies fats and grease.
- iii. Ammonia can be liquefied and transported easily and on decomposition it gives hydrogen whereas liquid hydrogen is dangerous to transport in cylinders.

Sample Question Paper - 3

Maximum Marks: 80

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes.
- This time is to be spent reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- **Section A** is compulsory. Attempt any four questions from **Section B**.
- The intended marks for questions or parts of questions are given in brackets [].

1. **Question 1** Choose one correct answer to the questions from the given options: [15]

- (a) The set representing the correct order of first ionisation energy is [1]
- a) $K > Na > Li$ b) $B > C > N$
- c) $Ge > Si > C$ d) $Be > Mg > Ca$
- (b) The number of electrons present in the valence shell of a halogen is _____. [1]
- a) 1 b) 7
- c) 5 d) 3
- (c) Which of the following does not conduct electricity? [1]
- a) Molten NaOH b) Solid NaCl
- c) Aqueous NaCl d) Molten KOH
- (d) The drying agent used to dry HCl gas is: [1]
- a) CaO b) Al_2O_3
- c) ZnO d) conc. H_2SO_4
- (e) An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change? [1]
- a) Hydrochloric acid b) Ammonium hydroxide solution
- c) Baking powder d) Lime
- (f) A metal which is amphoteric in nature. [1]
- a) Sodium b) Copper
- c) Zinc d) Manganese

- (g) If N_A is Avogadro's number, then the number of oxygen atom in one g-equivalent of oxygen is [1]
 a) N_A
 b) $\frac{N_A}{4}$
 c) $2N_A$
 d) $\frac{N_A}{2}$

(h) The perfect example of an ideal gas is: [1]
 a) None of these
 b) Hydrogen
 c) Water vapour
 d) Air

(i) During electrolysis of a concentrated aqueous solution of NaCl, what is the product at the cathode? [1]
 a) Hydrogen
 b) Sodium
 c) Oxygen
 d) Chlorine

(j) The neutral oxide: [1]
 a) NO_2
 b) N_2O
 c) P_2O_5
 d) Fe_2O_3

(k) A solid which bursts into flames on addition of concentrated nitric acid is _____. [1]
 a) Alcohol
 b) Turpentine oil
 c) Ferric sulphate
 d) Saw dust

(l) Nitric acid was also called as [1]
 a) aqua hydroxide
 b) aqua nitrate
 c) aqua fortis
 d) aqua-regia

(m) An organic weak acid is _____ [1]
 a) Hydrochloric acid
 b) Sulphuric acid
 c) Formic acid
 d) Nitric acid

(n) The organic compound obtained as the end product of the fermentation of sugar solution is: [1]
 a) Methanol
 b) Ethane
 c) Methanoic acid
 d) Ethanol

(o) The reaction of alcohol with acetic acid in the presence of concentrated sulphuric acid is known as [1]
 a) saponification
 b) distillation
 c) esterification
 d) condensation

2. **Question 2** [25]

- (a) i. Why silver nitrate is dissolved in tap water? [5]
- ii. A compound A when warmed with dilute sulphuric acid, gives a gas. Name that gas.
- iii. Complete and balance the following reaction.
- $$\text{NH}_3 + \text{O}_2 \longrightarrow \text{N}_2 + \text{H}_2\text{O}$$
- $$\text{N}_2 + \text{H}_2 \rightleftharpoons \text{NH}_3$$
- $$\text{Mg} + \text{N}_2 \longrightarrow \text{Mg}_3\text{N}_2 \rightarrow \text{Ma}(\text{OH})_2$$
- (b) Match the salts given in Column I with their method of preparation given in Column II: [5]

Column I	Column II
(a) $\text{Pb}(\text{NO}_3)_2$ from PbO	(i) Simple displacement
(b) MgCl_2 from Mg	(ii) Titration
(c) FeCl_3 from Fe	(iii) Neutralisation
(d) NaNO_3 from NaOH	(iv) Combination

(c) **Complete the following by choosing the correct answers from the bracket:**

- As we move across the period metallic characters _____. (decreases/increases) [1]
- _____ indicators can differentiate between the acidic or basic solutions of different pH values. [1]
- The number of molecules present in 35.5 g of chlorine is _____ $\times 10^{23}$. (3.01/6.02) [1]
- Electrolysis of aqueous sodium chloride solution will form _____ at the cathode, (hydrogen gas/sodium metal) [1]
- Ammonia gas is collected by _____ (an upward displacement of air/a downward displacement of water/a downward displacement of air) [1]

(d) **Identify the following:**

- Series of compounds having similar structural formulae, same functional group and similar chemical properties. [1]
- The gas evolved in warming ammonium sulphate with sodium hydroxide solution. [1]
- The particle that move when electric current is passed through metal wire. [1]
- The process by which soluble salt like sodium sulphate can be prepared. [1]
- The most metallic element in its respective group is placed at the _____. (top/bottom) [1]

(e) i. A gaseous compound of nitrogen and hydrogen contains 12.5% hydrogen by mass. Find the molecular formula of the compound if its relative molecular mass is 37. [2]

(N = 14, H = 1)

ii. The following table shows the electronic configuration of the elements W, X, Y, Z: [3]

Element	W	X	Y	Z
Electronic Configuration	2, 8, 1	2, 8, 7	2, 5	1

Answer the following questions based on the table above:

- What type of bond is formed between?
 - W and X
 - X and Y
- What is the formula of the compound formed between?
 - X and Z
 - W and X

Section B

Attempt any 4 questions

3. **Question 3** [10]

(a) i. Of the two gases, ammonia and hydrogen chloride, which is more dense? Name the method of [2]

collection of this gas.

ii. Give one example of a reaction between the above two gases which produces a solid compound.

(b) **Write the products and balance the equation.**

i. Sodium thiosulphate is reacted with dilute hydrochloric acid [1]

ii. Lead sulphate from lead carbonate. [1]

(c) **Arrange the following as per the instruction given in the brackets:**

i. He, Ar, Ne (Increasing order of the number of shells) [1]

ii. F, B, N, O (In the increasing order of electron affinity) [1]

iii. Cs, Na, Li, K, Rb (increasing order of metallic character) [1]

(d) **Fill in the blanks by selecting the appropriate word from the given choice:**

i. Two adjacent members of homologous series differ by CH_2 units and _____ amu. [1]

ii. A carbon atom linked with two carbon atoms is known as _____ carbon. [1]

iii. CH_2O is an _____ for the molecular formula, $\text{C}_6\text{H}_{12}\text{O}_6$. [1]

4. **Question 4** [10]

(a) What is lone pair effect? In what kind of compound does this effect occur? [2]

(b) Given: $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$ [2]

2000 cc of O_2 was burnt with 400 cc of ethane.

Calculate the volume of CO_2 formed and unused O_2 .

(c) The following questions related to the extraction of aluminium by electrolysis: [3]

i. Give the equation for the reaction that takes place at cathode.

ii. Explain why it is necessary to renew anode from time to time.

iii. What is the role of graphite?

(d) **Explain the following:**

i. Cast iron is used to make castings. [1]

ii. An aqueous solution of the salt ammonium chloride is acidic in nature while an aqueous solution of sodium chloride is neutral. [1]

iii. Although copper is a good conductor of electricity, it is a non-electrolyte. [1]

5. **Question 5** [10]

(a) i. Which will give red precipitate with ammoniacal cuprous chloride solution? Identify the substance. [1]

ii. How is methanol converted to methanal? [1]

(b) State the type of bonding in the following molecules: [2]

i. Water

ii. Calcium oxide

(c) **Give balanced chemical equation for the following:**

i. Ammonia is oxidised by a metal oxide [1]

ii. Lead nitrate is heated in a dry test tube [1]

iii. Ammonium chloride is warmed with concentrated sulphuric acid [1]

(d) **State one relevant observation for each of the following reactions:**

i. Dilute hydrochloric acid is added to sodium thiosulphate. [1]

ii. Sodium hydroxide solution is added to ferric chloride solution at first a little and then in excess. [1]

iii. Electricity is passed through molten lead bromide. [1]

6. **Question 6** [10]

(a) i. What is meant by a group in the periodic table? [2]

ii. Within a group where would you expect to find the element with:

a. the greatest metallic character?

b. the largest atomic size?

(b) i. If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75 cc of B? The gases A and B are under the same conditions of temperature and pressure. [2]

ii. Name the law on which the above problems is based.

(c) List three characteristics of isomers. [3]

(d) Distinguish between the following pairs of compounds using the reagent given in the bracket. [3]

i. Manganese dioxide and copper (II) oxide. (using concentrated HCl).

ii. Ferrous sulphate solution and ferric sulphate solution. (using sodium hydroxide solution).

iii. Dilute hydrochloric acid and dilute sulphuric acid. (using lead nitrate solution).

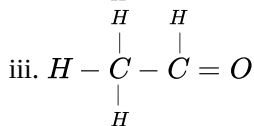
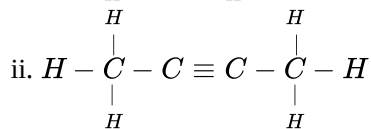
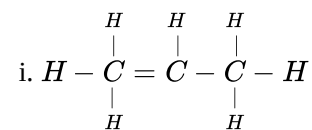
7. **Question 7** [10]

(a) NaCl has a high melting point and boiling point as compared to carbon tetrachloride. Why? [2]

(b) Calculate the mass percent of each element of water. [2]

(c) Differentiate between electrical conductivity of copper sulphate solution and copper metal. [3]

(d) Write the IUPAC names of each of the following. [3]



8. **Question 8** [10]

(a) An element L consists of molecules: [2]

i. What type of bonding is present in the particle that make up L?

ii. When L is heated with iron metal, it forms a compound FeL. What chemical term would you use to describe the change undergone by L?

(b) What are the applications of Avogadro's law? [2]

(c) The pH values of three solutions A, B and C are given in the table. [3]

Answer the following questions:

Solution	pH value
A	12
B	2

- i. Which solution will have no effect on litmus solution?
 - ii. Which solution will liberate CO_2 when reacted with sodium carbonate?
 - iii. Which solution will turn red litmus solution blue?
- (d)
- i. Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. [3]
 - ii. State why concentrated sulphuric acid is not used for drying ammonia gas.
 - iii. Why is ammonia gas not collected over water?

Solution

Section A

1. Question 1 Choose one correct answer to the questions from the given options:

- (i) **(d)** $\text{Be} > \text{Mg} > \text{Ca}$

Explanation: {

$\text{Be} > \text{Mg} > \text{Ca}$

- (ii) **(b)** 7

Explanation: {

7

- (iii) **(b)** Solid NaCl

Explanation: {

As, attractive force between ions in solid state are very strong and ions are not free to move, therefore they do not conduct electricity in solid state.

NaCl (solid) is an ionic solid hence, do not conduct electricity.

- (iv) **(d)** conc. H_2SO_4

Explanation: {

conc. H_2SO_4

- (v) **(a)** Hydrochloric acid

Explanation: {

Hydrochloric acid

- (vi) **(c)** Zinc

Explanation: {

Zinc

- (vii) **(b)** $\frac{N_A}{4}$

Explanation: {

Each oxygen atom in $\text{O}_2(\text{g})$ bear two electrons.

Thus, 1 g equivalent of $\text{O}_2 = \frac{N_A}{2}$

Hence, 1 g equivalent of oxygen atom = $\frac{N_A}{4}$

- (viii) **(a)** None of these

Explanation: {

None of these

- (ix) **(a)** Hydrogen

Explanation: {

Hydrogen

- (x) **(b)** N_2O

Explanation: {

N_2O

- (xi) **(d)** Saw dust

Explanation: {

Saw dust

- (xii) **(c)** aqua fortis

Explanation: {

aqua fortis

(xiii) (c) Formic acid

Explanation: {
Formic acid

(xiv) (d) Ethanol

Explanation: {
Ethanol

(xv) (c) esterification

Explanation: {
esterification

2. Question 2

(i) i. Silver nitrate is dissolved in tap water because tap water contains sodium chloride thus, silver nitrate reacts with it to form a curdy white precipitate.

ii. Sulphite, SO_3^{2-}

iii. $4\text{NH}_3 + 3\text{O}_2 \longrightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$

$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{Heat}$

Catalyst - Iron

Promoter - Molybdenum

Temp. - $450-500^\circ\text{C}$

Pressure (atm) - 200-1000 atm

$3\text{Mg} + \text{N}_2 \longrightarrow \text{Mg}_3\text{N}_2 \xrightarrow{6\text{H}_2\text{O}} 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3 \uparrow$

(ii) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

(iii) Complete the following by choosing the correct answers from the bracket:

i. 1. decreases

ii. 1. Universal

iii. 1. 3.01

iv. 1. Hydrogen gas

v. 1. Downward displacement of air

(iv) Identify the following:

i. 1. Homologous series

ii. 1. Ammonia

iii. 1. Electron

iv. 1. Titration

v. 1. bottom

(v)

Element	Percentage	Atomic mass	No. of atoms	Simplest ratio
N	87.5	14	$\frac{87.5}{14} = 6.25$	$\frac{6.25}{6.25} = 1$
H	12.5	1	$\frac{12.5}{1} = 12.5$	$\frac{12.5}{6.25} = 2$

Empirical formula of compound = NH_2

Empirical formula weight = $14 + 2 = 16$

Molecular weight = 37 n = $\frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{37}{16} = 2.3 = 2$

Molecular formula = $(\text{NH}_2)_2 = \text{N}_2\text{H}_4$.

ii. i. a. Electrovalent bond or ionic bond

b. Covalent bond

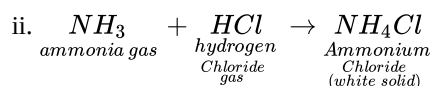
ii. a. ZX

b. WX

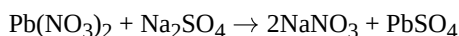
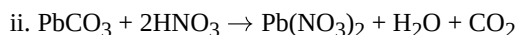
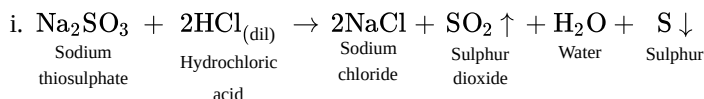
Section B

3. Question 3

(i) i. Hydrogen chloride is denser than ammonia. It is collected by upward displacement of air.



(ii) Write the products and balance the equation.



(iii) Arrange the following as per the instruction given in the brackets:

i. He < Ne < Ar

ii. B, N, O, F

iii. Li < Na < K < Rb < Cs (increasing order)

(iv) Fill in the blanks by selecting the appropriate word from the given choice:

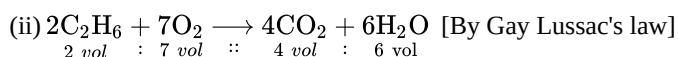
i. 1. 14

ii. 1. Catenation

iii. 1. empirical formula

4. Question 4

(i) When the unshared pair of electrons around an atom in the middle of a molecule is completely shared by another atom or an ion, it is called lone pair effect. Lone pair effect is shown by polar covalent compounds such as HCl and NH₃.



$\begin{matrix} 2 \text{ vol} & : & 7 \text{ vol} & :: & 4 \text{ vol} & : & 6 \text{ vol} \end{matrix}$

2 volumes of C₂H₆ give 4 volumes of CO₂

400 cc of C₂H₆ gives $\frac{4}{2} \times 400$ cc of CO₂

400 cc of C₂H₆ gives 800 cc of CO₂

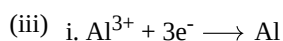
So, CO₂ produced = 800 cc

2 Volume of C₂H₆ uses 7 volumes of O₂

400 cc of C₂H₆ uses $\frac{7}{2} \times 400$ volumes of O₂

400 cc of C₂H₆ uses 1400 volumes of O₂

Unused O₂ = 2000 - 1400 = 600 cc



ii. Anode is renewed from time to time because they get oxidized.

iii. Graphite acts as anode.

(iv) Explain the following:

i. This is due to fact that cast iron expands on solidification. It takes the shape of the mould and is used to make castings.

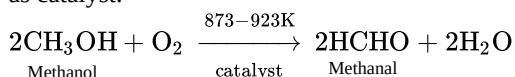
ii. Ammonium chloride is a salt of weak base and strong acid. It undergoes salt hydrolysis to produce an acidic solution whereas sodium chloride is a salt of strong acid and strong bases, it does not undergo salt hydrolysis. Hence, its solution remains neutral.

iii. An electrolyte must have free ions which act as charge carriers whereas in copper the free electrons act as charge carriers.

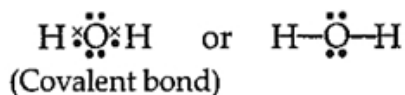
5. Question 5

(i) i. Ethyne

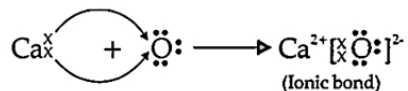
ii. Methanal is prepared by the controlled oxidation of methanol (CH₃OH) at 873-923 K and using silver or iron oxide as catalyst.



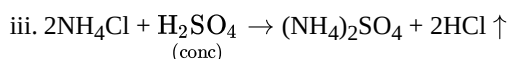
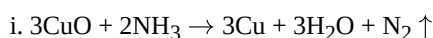
- (ii) i. Electron dot Structure of water (H₂O)



- ii. Electron dot structure of calcium oxide (CaO)



- (iii) Give balanced chemical equation for the following:



- (iv) State one relevant observation for each of the following reactions:

i. Gas (SO₃) evolved which turns potassium dichromate paper from orange to green and yellow particles of sulphur.

ii. A reddish brown ppt. of ferric hydroxide is formed which remains insoluble in excess of sodium hydroxide.

iii. A silvery white metal of Pb (lead) is deposited at cathode.

6. Question 6

- (i) i. The vertical column in the periodic table is called a group.

ii. a. Bottom of the group

b. Bottom of the group

- (ii) i. 150 cc of gas A = X mole

150 cc of gas B = X mole

1 cc of gas B = $\frac{X}{150}$ mole

75 cc of gas B = $\frac{X}{150} \times 75$

= $\frac{75 \times X}{150} = \frac{X}{2}$ molecules

ii. Avogadro's law

- (iii) i. They have same molecular formula.

ii. They have different physical and chemical properties.

iii. They have same molecular mass.

- (iv) i. On adding concentrated hydrochloric acid if a greenish yellow gas is evolved it is Manganese dioxide. If no gas is evolved it is CuO.

ii. On adding sodium hydroxide solution if a dirty green precipitate is formed it is ferrous sulphate solution. If a reddish-brown precipitate is formed, it is Ferric sulphate solution.

iii. On adding lead nitrate solution, if white precipitate is formed which dissolves on heating, then it is dilute HCl. If white precipitate formed does not dissolve on heating, it is dilute H₂SO₄.

7. Question 7

- (i) Sodium chloride has high melting point and boiling point because it has strong electrostatic force of attraction between its ions hence, more energy is required whereas carbon tetrachloride has weak van der Waals forces of attraction and hence, energy required is less.

- (ii) Molar mass of H₂O = 2 × atomic mass of H + 1 × atomic mass of O

$$= 2 \times 1.01 + 1 \times 16.00 = 18.02 \text{ g}$$

$$\text{Mass \% of hydrogen} = \frac{2 \times 1.008}{18.02} \times 100 = 11.18\%$$

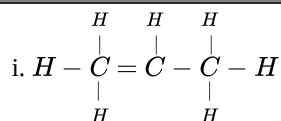
$$\text{Mass \% of oxygen} = \frac{16.00}{18.02} \times 100 = 88.79\%$$

- (iii)

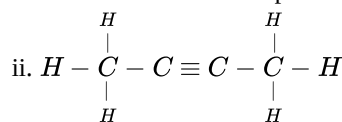
Copper metal	Electrolyte- CuSO ₄ Solution
The flow of electricity takes place by flow of electrons which have negligible mass.	The flow of electricity takes place by flow of ions which are dense particles as compared to electrons.
There is no decomposition of the parent metal and thus the chemical properties of the metal are intact.	Decomposition of the electrolytic solution takes place and thus the chemical properties of the electrolyte are altered.

Metals are good conductors of electricity in the solid state and in the molten state.	Electrolytes are good conductors of electricity in aqueous solution or molten state but do not conduct in the solid state.
During metallic conduction, there is no transfer of matter. The flow of electricity only produces heat energy and no new products are formed.	Electrolytic conduction involves transfer of ions. The electrolyte is decomposed and new products are formed.

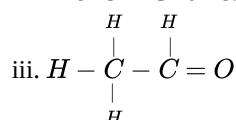
(iv)



The IUPAC name: Prop-1-ene



The IUPAC name: But-2-yne



The IUPAC name: Ethanal

8. Question 8

- (i) i. Covalent bonding since L consists of molecules.
ii. L is getting reduced.
- (ii) i. It determines the molecular formula of a gas.
ii. It determines atomicity of gases.
iii. It explains Gay-Lussac's law of combining volumes.
iv. It establishes the relation between molecular weight and vapour density of a gas.
- (iii) i. C/pH 7
ii. B/pH 2
iii. A/pH 12
- (iv) i. $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \xrightarrow{\Delta} \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{NH}_3 \uparrow$
ii. Concentrated sulphuric acid reacts with ammonia/form ammonium sulphate or NH_3 being basic combines with concentrated H_2SO_4 /as follow in chemical equation.
$$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2 \underset{\text{salt}}{\text{SO}_4}$$

iii. NH_3 is highly soluble in water or dissolves in water.

X - ICSE BOARD - 2018

Date: 19.03.2018

Chemistry - Question Paper Solutions

SECTION - I (40 Marks)

Attempt all questions from this Section

Question 1

(a) Choose the correct answer from the options given below :

(i) The salt solution which does not react with ammonium hydroxide is :

(A) Calcium Nitrate

(B) Zinc Nitrate

(C) Lead Nitrate

(D) Copper Nitrate

Ans. (A) Calcium Nitrate

(ii) The organic compound which undergoes substitution reaction is :

(A) C_2H_2

(B) C_2H_4

(C) $C_{10}H_{18}$

(D) C_2H_6

Ans. (D)

C_2H_6 - ethane is saturated hydrocarbon which undergoes substitution reaction.

(iii) The electrolysis of acidified water is an example of :

(A) Reduction

(B) Oxidation

(C) Redox reaction

(D) Synthesis

Ans. (C)

Redox reaction, as water undergoes oxidation and reduction at anode and cathode respectively.

(iv) The IUPAC name of dimethyl ether is :

(A) Ethoxy methane

(B) Methoxy methane

(C) Methoxy ethane

(D) Ethoxy ethane

Ans. (B)

$CH_3 - O - CH_3$ (Methoxy methane)

(v) The catalyst used in the contact process is :

(A) Copper

(B) Iron

(C) Vanadium pentoxide

(D) Manganese dioxide

Ans. (C)

V_2O_5 is used in contact process.

(b) Give one word or a phrase for the following statements :

(i) The energy released when an electron is added to a neutral gaseous isolated atom to form a negatively charged ion.

Ans. Electron affinity or electron gain enthalpy.

(ii) Process of formation of ions from molecules which are not in ionic state.

Ans. Ionization

(iii) The tendency of an element to form chains of identical atoms.

Ans. Catenation - It's a self linking.

Property of atoms like carbon to give long chains of carbon.

(iv) The property by which certain hydrated salts, when left exposed to atmosphere, lose their water of crystallization and crumble into powder.

Ans. Dehydration

(v) The process by which sulphide ore is concentrated.

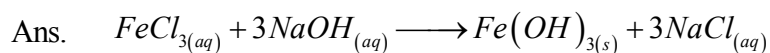
Ans. Froth floatation

(c) Write a balanced chemical equation for each of the following :

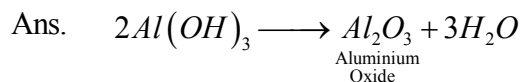
(i) Action of concentrated sulphuric acid on carbon.

Ans. $C_{(s)} + H_2SO_4 \longrightarrow CO_2 + 2SO_2 + 2H_2O$
conc.

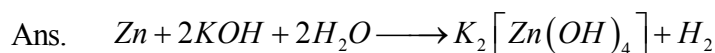
(ii) Reaction of sodium hydroxide solution with iron (III) chloride solution.



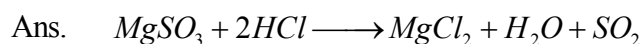
(iii) Action of heat on aluminium hydroxide.



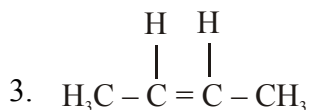
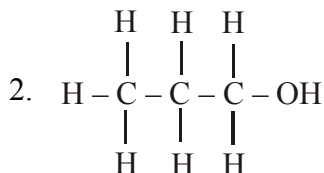
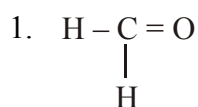
(iv) Reaction of zinc with potassium hydroxide solution.



(v) Action of dilute hydrochloric acid on magnesium sulphite.



(d) (i) Give the IUPAC name for each of the following :

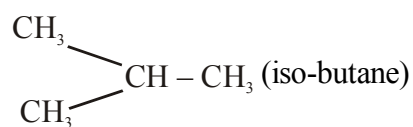


(ii) Write the structural formula of the two isomers of butane.

Ans. (i) IUPAC Names :

1. Methanal 2. Propanol 3. But-2-ene

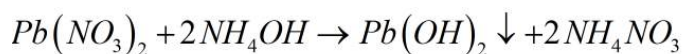
(ii) $CH_3 - CH_2 - CH_2 - CH_3$ (n-butane)



(e) State one relevant observation for each of the following :

(i) Lead nitrate solution is treated with sodium hydroxide solution drop wise till it is excess.

Ans. ppt. of lead hydroxide is observed



(ii) At the anode, when molten lead bromide is electrolyzed using graphite electrodes.

Ans. Brown fumes of bromine gas are observed at anode.

(iii) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.

Ans. White ppt. of $PbCl_2$ is formed.

(iv) Anhydrous calcium chloride is exposed to air for some time.

Ans. Anhydrous $CaCl_2$ on exposure to atmosphere form solution.

(v) Barium chloride solution is slowly added to sodium sulphate solution.

Ans. White ppt. of barium sulphate is formed solution turns turbid.

(f) Give a reason for each of the following :

(i) Ionic compounds have a high melting point.

Ans. Ionic compounds have alternatively arranged cations and anions to give closely packed structure and balanced forces. A lot of energy is needed to break strong ionic bonds therefore ionic compounds have high melting point.

(ii) Inert gases do not form ions.

Ans. Inert gases have stable completely filled orbitals hence they do not loose or gain electron to form ions.

(iii) Ionisation potential increases across a period, from left to right.

Ans. From left to right in periodic table, atomic size decreases smaller the size more the effective nuclear charge.

Therefore more energy is required to remove an electron from atom therefore ionization potential increases.

(iv) Alkali metals are good reducing agents.

Ans. Alkali metals have large size and single electron in valence shell. This e^- can be easily lost therefore alkali metals are good reducing agents (e^- donors)

(v) Conductivity of dilute hydrochloric acid is greater than that of acetic acid.

Ans. Acetic acid is weak electrolyte which dissociated partially where as HCl is strong electrolyte which dissociate completely therefore HCl is better conductor compared to CH_3COOH .

(g) Name the gas that is produced in each of the following cases :

(i) Sulphur is oxidized by concentrated nitric acid.

(ii) Action of dilute hydrochloride acid on sodium sulphide.

(iii) Action of cold and dilute nitric acid on copper.

(iv) At the anode during the electrolysis of acidified water.

(v) Reaction of ethanol and sodium.

Ans. (i) SO_2

(ii) H_2S

(iii) NO_2

(iv) O_2

(v) H_2

(h) Fill up the blanks with the correct choice given in brackets.

(i) Ionic or electrovalent compounds do not conduct electricity in their _____ state. (fused/solid)

Ans. Solid

(ii) Electrolysis of aqueous sodium chloride solution will form _____ at the cathode.

(Hydrogen gas / Sodium metal)

Ans. Hydrogen gas

(iii) Dry hydrogen chloride gas can be collected by _____ displacement of air. (downward / upward)

Ans. Downward

(iv) The most common ore of iron is _____. (Calcium / Haematite)

Ans. Haematite

(v) The salt prepared by the method of direct combination is _____.

(iron (II) chloride / iron (III) chloride)

Ans. Iron (III) chloride

SECTION - II (40 Marks)

Attempt any four questions from this Section

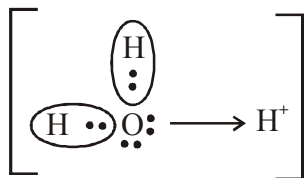
Question 2

(a) (i) What do you understand by a lone pair of electrons?

(ii) Draw the electron dot diagram of Hydronium ion ($H = 1$; $O = 8$)

Ans. (i) Lone pair of electrons are those valence electrons which do not take part in bonding and remain nonbonded.

(ii) Hydronium ion $[H_3O^+]$



(b) In Period 3 of the Periodic Table, element B is placed to the left of element A.

On the basis of this information, choose the correct word from the brackets to complete the following statements:

(i) The element B would have (lower / higher) metallic character than A.

(ii) The element A would probably have (lesser / higher) electron affinity than B.

(iii) The element A would have (greater / smaller) atomic size than B.

Ans. Periodic table

- (i) Higher - Metallic character decreases from left to right.
- (ii) Higher - Electron affinity increases from left to right.
- (iii) Smaller - Atomic size decreases from left to right.

(c) Copy and complete the following table which refers to the conversion of ions to neutral particles.

Conversion	Ionic equation	Oxidation / Reduction
Chloride ion to chlorine molecule	(i) _____	(ii) _____
Lead (II) ion to lead	(iii) _____	(iv) _____

Ans.

Conversion	Ionic equation	Oxidation / Reduction
Chloride ion to chlorine molecule	(i) $2Cl^- \rightarrow Cl_2 + 2e^-$	(ii) Oxidation
Lead (II) ion to lead	(iii) $Pb^{+2} + 2e^- \rightarrow Pb$	(iv) Reduction

Question 3

- (a)
- (i) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali.
 - (ii) State why concentrated sulphuric acid is not used for drying ammonia gas.
 - (iii) Why is ammonia gas not collected over water ?

Ans. (i) $Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2H_2O + 3NH_3 \uparrow$

(ii) As ammonia gas is basic in nature it forms ammonium sulphate salt.

(iii) Ammonia gas is highly soluble in water. Therefore it is not collected over water.

- (b)
- (i) Name the acid used for the preparation of hydrogen chloride gas in the laboratory. Why is this particular acid preferred to other acids?

(ii) Write the balanced chemical equation for the laboratory preparation of hydrogen chloride gas.

Ans. (i) H_2SO_4 (Sulphuric acid is used for preparation of HCl gas in laboratory). H_2SO_4 has dehydrating properties so act as dehydrating agent.

(ii) $H_2SO_{4(aq)} + NaCl_{(s)} \longrightarrow NaHSO_{4(aq)} + HCl_{(g)}$

(c) For the preparation of hydrochloric acid in the laboratory:

- (i) Why is direct absorption of hydrogen chloride gas in water not feasible?
- (ii) What arrangement is done to dissolve hydrogen chloride gas in water?

Ans. (i) The reaction is highly exothermic.

- (ii) As the reaction is exothermic, the installation is called HCl over or burner. The HCl gas is absorbed in deionized water resulting in chemically pure HCl.

(d) For the electro-refining of copper :

- (i) What is the cathode made up of?
- (ii) Write the reaction that takes place at the anode.

Ans. (i) Pure copper metal

- (ii) Reaction at anode -



Question 4

(a) The percentage composition of a gas is:

Nitrogen 82.35%, Hydrogen 17.64%.

Find the empirical formula of the gas. [N = 14, H = 1]

Ans. No. of mole of nitrogen = $\frac{82.35}{14} = 5.88$

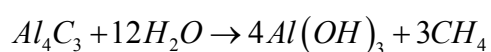
No. of mole of Hydrogen = $\frac{17.64}{1} = 17.64$

The ratio of their mole is 5.88:17.64

1 : 3

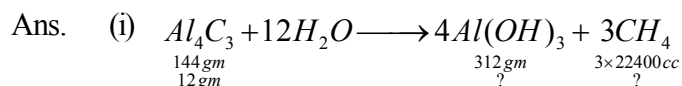
So the empirical formula is NH_3

(b) Aluminum carbide reacts with water according to the following equation :



- (i) What mass of aluminum hydroxide is formed from 12g of aluminum carbide ?
- (ii) What volume of methane at s.t.p. is obtained from 12g of aluminum carbide?

[Relatively molecular weight of $Al_4C_3 = 144$; $Al(OH)_3 = 78$]



So, the amount of $Al(OH)_3$ formed will be 26 gm

(ii) From 12 gm Al_4C_3 5600 cc methane will be formed.

(c) (i) If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75 cc of B?

The gases A and B are under the same conditions of temperature and pressure.

(ii) Name the law on which the above problem is based.

Ans. (i) According to Avogadro's law equal volume of gases contain equal no. of molecule of same temperature and pressure.

So, 150 cc B will also contain X molecule, and 75 cc will contain X/2 molecule.

(ii) Avogadro's law

(d) Name the main component of the following alloys:

(i) Brass

(ii) Duralumin

Ans. Brass \rightarrow Copper and Zinc

Duralumin \rightarrow Copper, Manganese and Magnesium

Question 5

(a) Complete the following table which relates to the homologous series of hydrocarbons.

General Formula	IUPAC name of the homologous series	Characteristic bond type	IUPAC name of the first member of the series
C_nH_{2n-2}	(A) _____	(B) _____	(C) _____
C_nH_{2n+2}	(D) _____	(E) _____	(F) _____

Ans. (A) Alkyne (B) $-C \equiv C-$ (C) Ethyne

(D) Alkane (E) $\begin{array}{c} | \quad | \\ -C-C- \\ | \quad | \end{array}$ (F) Methane

- (b) (i) Name the most common ore of the metal aluminum from which the metal is extracted. Write the chemical formula of the ore.
- (ii) Name the process by which impure ore of aluminum gets purified by using concentrated solution of an alkali.
- (iii) Write the equation for the formation of aluminum at the cathode during the electrolysis of alumina.

Ans. (i) The most common ore of Al is bauxite. Chemical formula is Al_2O_3 .

(ii) The process is called Bayer process.

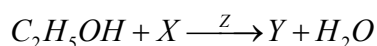
(iii) $Al_2O_3 \longrightarrow 2Al^{+3} + 3O^{2-}$

Reaction of cathode: $2Al^{+3} + 6e \longrightarrow 2Al$

Question 6

- (a) A compound X (having vinegar like smell) when treated with ethanol in the presence of the acid Z, gives a compound Y which has a fruity smell.

The reaction is:



- (i) Identify Y and Z.
- (ii) Write the structural formula of X.
- (iii) Name the above reaction.

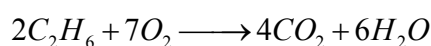
Ans. (i) Y is ester $CH_3COOC_2H_5$ (Ethyl ethanoate)

Z is concentrated H_2SO_4

(ii) X is CH_3COOH

(iii) Esterification reaction

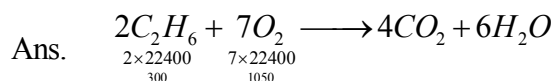
- (b) Ethane burns in oxygen to form CO_2 and H_2O according to the equation:



If 1250 cc of oxygen is burnt with 300 cc of ethane.

Calculate:

- (i) the volume of CO_2 formed.
- (ii) the volume of unused O_2



So, ethane is limiting reagent.

(i) 2×22400 cc ethane gives $\rightarrow 4 \times 22400$ cc CO_2

$$\therefore 300 \text{ cc ethane gives } \rightarrow \frac{4 \times 22400 \times 300}{2 \times 22400} \text{ cc } CO_2$$

$$= 600 \text{ cc } CO_2$$

(ii) For 300 cc Ethane 1050 cc of O_2 will be required.

So, unused O_2 is $(1250 - 1050) = 200$ cc

(c) Three solutions P, Q and R have pH value of 3.5, 5.2 and 12.2 respectively. Which one of these is a:

(i) Weak acid?

(ii) Strong alkali?

Ans. (i) Q having pH 5.2 is weak acid

(ii) R having pH 12.2 is strong alkali.

Question 7

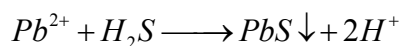
(a) Give a chemical test to distinguish between the following pairs of chemicals:

(i) Lead nitrate solution and Zinc nitrate solution

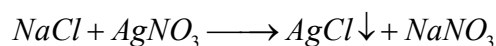
(ii) Sodium chloride solution and Sodium nitrate solution

Ans. (i) Lead nitrate and Zinc nitrate solution can be distinguished by passing H_2S in solution.

$Pb(NO_3)_2$ will give black precipitate of PbS whereas $Zn(NO_3)_2$ will not.



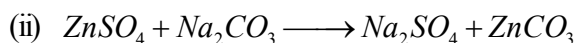
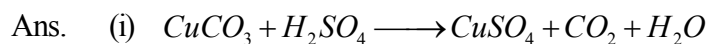
(ii) $NaCl$ and $NaNO_3$ solution can be distinguished simply by addition of $AgNO_3$ solution into it $NaCl$ solution will give white precipitate of $AgCl$ whereas $NaNO_3$ will not.



(b) Write a balanced equation for the preparation of each of the following salts:

(i) Copper sulphate from Copper carbonate.

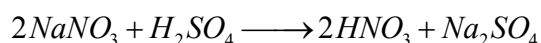
(ii) Zinc carbonate from Zinc sulphate.



(c) (i) What is the type of salt formed when the reactants are heated at a suitable temperature for the preparation of Nitric acid?

(ii) State why for the preparation of Nitric acid, the complete apparatus is made up of glass.

Ans. (i) Sodium or potassium nitrate on reaction with H_2SO_4 can produce nitric acid in that case sulphate salt will be prepared.



(ii) Because nitric acid will not react with glass.

(d) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with:

(i) Ethanol?

(ii) Carbon?

Ans. (i) Sulphuric acid acts as a dehydrating agent while reaction with ethanol.

(ii) With carbon it will act as oxidizing reagent.

**ICSE Board
Class X Chemistry
Board Paper - 2019**

Time: 2 hrs.

Max. Marks: 80

Answers to this Paper must be written on the paper provided separately.
You will not be allowed to write during the first 15 minutes.
This time is to be spent in reading the Question Paper.
The time given at the head of this paper is the time allowed for writing the answers.

Section I is compulsory. Attempt any four questions from **Section II**.
The intended marks for questions or parts of questions are given in brackets [].

SECTION I (40 Marks)
Attempt all questions from this Section

Question 1

(a) Choose the correct answer from the options given below: [5]

(i) An electrolyte which completely dissociates into ions is

- A. Alcohol
- B. Carbonic acid
- C. Sucrose
- D. Sodium hydroxide

(ii) The most electronegative element from the following elements is

- A. Magnesium
- B. Chlorine
- C. Aluminium
- D. Sulphur

(iii) The reason for using aluminium in the alloy duralumin is

- A. Aluminium is brittle.
- B. Aluminium gives strength.
- C. Aluminium brings lightness.
- D. Aluminium lowers melting point.

(iv) The drying agent used to dry HCl gas is

- A. Conc. H_2SO_4
- B. ZnO
- C. Al_2O_3
- D. CaO

(v) A hydrocarbon which is a greenhouse gas is

- A. Acetylene
- B. Ethylene
- C. Ethane
- D. Methane

(b) Fill in the blanks with the choices given in brackets: [5]

- (i) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of _____. (Dehydration/dehydrogenation/dehydrohalogenation)
- (ii) When sodium chloride is heated with concentrated sulphuric acid below 200°C, one of the products formed is _____. (Sodium hydrogen sulphate/sodium sulphate/chlorine)
- (iii) Ammonia reacts with excess chlorine to form _____. (Nitrogen/nitrogen trichloride/ammonium chloride)
- (iv) Substitution reactions are characteristic reactions of _____. (Alkynes/alkenes/alkanes)
- (v) In Period 3, the most metallic element is _____. (Sodium/magnesium/aluminium)

(c) Write a balanced chemical equation for each of the following reactions: [5]

- (i) Reduction of copper (II) oxide by hydrogen.
- (ii) Action of dilute sulphuric acid on sodium hydroxide.
- (iii) Action of dilute sulphuric acid on zinc sulphide.
- (iv) Ammonium hydroxide is added to ferrous sulphate solution.
- (v) Chlorine gas is reacted with ethane.

(d) State one observation for each of the following: [5]

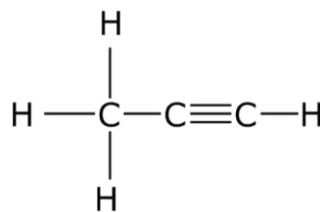
- (i) Concentrated nitric acid is reacted with sulphur.
- (ii) Ammonia gas is passed over heated copper (II) oxide.
- (iii) Copper sulphate solution is electrolysed using copper electrodes.
- (iv) A small piece of zinc is added to dilute hydrochloric acid.
- (v) Lead nitrate is heated strongly in a test tube.

(e) (i) Calculate: [5]

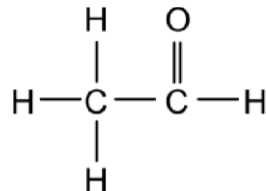
1. The number of moles in 12g of oxygen gas. [O = 16]
2. The weight of 10^{22} atoms of carbon. [C = 12, Avogadro's No. = 6×10^{23}]
- (ii) Molecular formula of a compound is $C_6H_{18}O_3$. Find its empirical formula.

(f) (i) Give the IUPAC name of the following organic compounds: [5]

1.



2.



- (ii) What is the special feature of the structure of ethyne?
- (iii) Name the saturated hydrocarbon containing two carbon atoms.
- (iv) Give the structural formula of acetic acid.

- (g) Give the appropriate term defined by the statements given below: [5]
- (i) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.
 - (ii) The substance that releases hydronium ion as the only positive ion when dissolved in water.
 - (iii) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.
 - (iv) The covalent bond in which the electrons are shared equally between the combining atoms.
- (h) Arrange the following according to the instructions given in brackets: [5]
- (i) K, Pb, Ca, Zn (In the increasing order of reactivity)
 - (ii) Mg^{2+} , Cu^{2+} , Na^{1+} , H^{1+} (In the order of preferential discharge at the cathode)
 - (iii) Li, K, Na, H (In the decreasing order of their ionisation potential)
 - (iv) F, B, N, O (In the increasing order of electron affinity)
 - (v) Ethane, methane, ethane, ethyne (In the increasing order of molecular weight)
- [H = 1, C = 12]

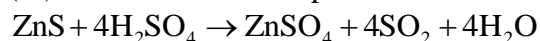
Solution 1:

- (a) (i) (D) Sodium hydroxide
 - (ii) (B) Chlorine
 - (iii) (C) Aluminium brings lightness.
 - (iv) (A) Conc. H_2SO_4
 - (v) (D) Methane
- (b) (i) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of dehydration.
- (ii) When sodium chloride is heated with concentrated sulphuric acid below 200°C , one of the products formed is sodium sulphate.
- (iii) Ammonia reacts with excess chlorine to form nitrogen trichloride.
- (iv) Substitution reactions are characteristic reactions of alkanes.
- (v) In Period 3, the most metallic element is sodium.
- (c) (i) The reduction of copper (II) oxide by hydrogen is

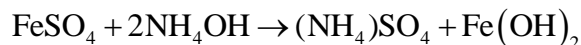
$$\text{CuO(s)} + \text{H}_2\text{(g)} \rightarrow \text{Cu(s)} + \text{H}_2\text{O(g)}$$
- (ii) Action of dilute sulphuric acid on sodium hydroxide is:

$$\text{H}_2\text{SO}_4\text{(aq)} + 2\text{NaOH(aq)} \rightarrow \text{Na}_2\text{SO}_4\text{(aq)} + \text{H}_2\text{O(l)}$$

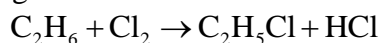
(iii) Action of dilute sulphuric acid on zinc sulphide is:



(iv) Ammonium hydroxide is added to ferrous sulphate solution:



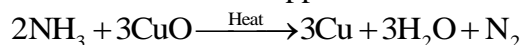
(v) Chlorine gas is reacted with ethane.



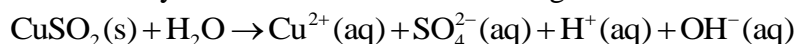
(d) (i) When concentrated nitric acid is added to sulphur, it gives a deep red-orange or brown-coloured gas which has an irritating (pungent) odour.



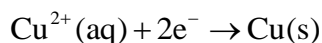
(ii) When ammonia gas is passed over heated copper (II) oxide, reddish brown copper metal is obtained and black copper oxide is used up.



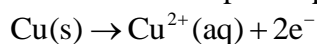
(iii) The blue colour of the copper sulphate solution remains unchanged during its electrolysis due to the copper electrodes and the cathode increase in size due to deposition of copper metal, whereas the copper anode gets thin due to loss of copper metal into the solution as Cu^{2+} ions. The electrolytic solution contains following ions:



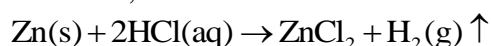
At cathode:



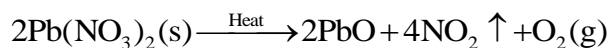
At anode made up of copper:



(iv) When a small piece of zinc is added to dilute hydrochloric acid, white coloured zinc chloride is formed, and colourless and odourless hydrogen gas is evolved.



(v) When lead nitrate is heated strongly in a test tube, the yellow compound formed and gives off a deep red-orange or brown coloured gas which having an irritating (pungent) odour.



(e) (i) 1. It is given that

Atomic mass of oxygen is 16g,

Thus, the molar mass of $\text{O}_2 = 16 \times 2 = 32\text{g}$

That is 32g oxygen gas has one molecule of O_2 molecules.

Therefore, 12g of oxygen gas would contain

$$\left(\frac{1}{32}\right) \times 12 = 0.375 \text{ moles.}$$

2. It is given that atomic weight of carbon is 12, and Avogadro's No. = 6×10^{23} .

Now, weight of one mole of Carbon is 12g.

Thus, weight of 6×10^{23} carbon atoms is 12g.

Hence, weight of 10^{22} carbon atoms is,

$$\left(\frac{12}{6 \times 10^{23}} \right) \times 10^{22} = 0.199 = 0.2\text{g}$$

(ii) Empirical formula can be obtained by dividing the number of atoms in molecule by the smallest number in the molecular formula-

It is given that Molecular formula of a compound is $\text{C}_6\text{H}_{18}\text{O}_3$.

Thus, the smallest number in formula is 3.

Now, dividing all the atoms by 3, we get,

The ratio of elements C:H:O is 2:6:1.

Therefore, the empirical formula of the compound is $\text{C}_2\text{H}_6\text{O}$.

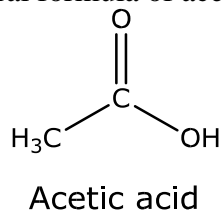
(f) (i) 1. The IUPAC name of the compound is Propylene.

2. The IUPAC name of the compound is Ethanal.

(ii) In ethyne, each carbon atom is attached to one hydrogen atom by a single covalent bond and to another carbon by a triple covalent bond. The shape of the ethyne molecule is linear due to *sp* hybridization in carbon atoms.

(iii) The saturated hydrocarbon containing two carbon atoms is Ethane (C_2H_6).

(iv) The structural formula of acetic acid is



(g) (i) Empirical formula

(ii) Acids

(iii) Electronegativity

(iv) Calcination

(v) Non-polar covalent bond

(h) (i) $\text{Pb} < \text{Zn} < \text{Ca} < \text{K}$

(ii) $\text{Cu}^{2+} > \text{H}^{1+} > \text{Mg}^{2+} > \text{Na}^{1+}$

(iii) $\text{H} > \text{Li} > \text{Na} > \text{K}$

(iv) $B < N < O < F$

(v) Methane < Ethyne < Ethene < Ethane

SECTION II (40 Marks)

Attempt any **four** questions from this Section

Question 2

(a) Draw the electron dot structure of [3]

(i) Nitrogen molecule [N = 7]

(ii) Sodium chloride [Na = 11, Cl = 17]

(iii) Ammonium ion [N = 7, H = 1]

(b) The pH values of three solutions A, B and C are given in the table. Answer the following questions: [3]

Solution	pH value
A	12
B	2
C	7

(i) Which solution will have no effect on litmus solution?

(ii) Which solution will liberate CO_2 when reacted with sodium carbonate?

(iii) Which solution will turn red litmus solution blue?

(c) Study the extract of the periodic table given below and answer the questions that follow. Give the letter corresponding to the element in question.

DO NOT repeat an element.

[4]

A																	
	B																

(i) Which element forms an electrovalent compound with G?

(ii) The ion of which element will migrate towards the cathode during electrolysis?

(iii) Which non-metallic element has the valency of 2?

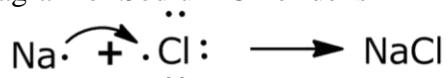
(iv) Which is an inert gas?

Solution 2:

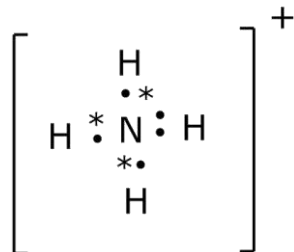
(i) Electron dot diagram of nitrogen molecule is -



(ii) Electron dot diagram of Sodium Chloride is –



(iii) Electron dot structure of Ammonium ion is-



(b)

Solution	pH value
A	12
B	2
C	7

(i) Solution C will have no effect on litmus solution as its pH is 7 and hence it is neutral.

(ii) Solution B will liberate CO_2 when reacted with sodium carbonate as it is acidic solution.

(iii) Solution A will turn red litmus solution blue as it is basic in nature.

(c)

(i) Element B forms an electrovalent compound with G.

(ii) The ion of element B (B^{2+}) will migrate towards the cathode during electrolysis.

(iii) The non-metallic element which has the valency of 2 is E.

(iv) F is an inert gas.

Question 3

(a) Name the particles present in [3]

(i) Strong electrolyte

(ii) Non-electrolyte

(iii) Weak electrolyte

(b) Distinguish between the following pairs of compounds using the reagent given in the brackets. [3]

- (i) Manganese dioxide and copper (II) oxide (using concentrated HCl)
- (ii) Ferrous sulphate solution and ferric sulphate solution (using sodium hydroxide solution)
- (iii) Dilute hydrochloric acid and dilute sulphuric acid (using lead nitrate solution)

(c) Choose the method of preparation of the following salts from the methods given in the list: [4]

[List: A. Neutralisation B. Precipitation
C. Direct combination D. Substitution]

- (i) Lead chloride
- (ii) Iron (II) sulphate
- (iii) Sodium nitrate
- (iv) Iron (III) chloride

Solution 3:

(a) (i) The particles present in strong electrolyte are molecules which easily and completely dissociate into ions.

(ii) The particles present in non-electrolytes are molecules which do not dissociate into ions.

(iii) The particles present in weak electrolytes are molecules which dissociate into ions to a very less extent.

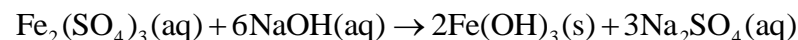
(b) (i) Manganese dioxide on heating with concentrated HCl gives greenish yellow chlorine gas whereas copper(II) oxide reacts with concentrated hydrochloric acid to give CuCl_2 , but no chlorine gas is evolved.



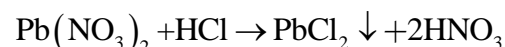
And,

Copper (II) oxide does not react with concentrated HCl.

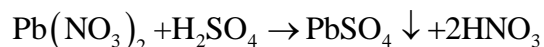
(ii) Ferric sulphate solution on reacting with NaOH gives a reddish brown precipitate of ferric hydroxide $\text{Fe}(\text{OH})_3$ whereas no such precipitate is obtained when ferrous sulphate is mixed with sodium hydroxide.



(iii) Lead nitrate solution reacts with hydrochloric acid to give white ppt. of lead chloride. This insoluble lead chloride reacts with excess Cl^- ions (of HCl) to form a soluble complex, the tetrachloroplumbate(II) ion,



Sulphuric acid on reacting with lead nitrate solution forms an insoluble precipitate of lead sulphate, which does not dissolve further in sulphuric acid solution.



(c)

- (i) Lead chloride: Precipitation
- (ii) Iron (II) sulphate: Substitution
- (iii) Sodium nitrate: Neutralisation
- (iv) Iron (III) chloride: Direct combination

Question 4

(a) Complete the following equations: [3]

- (i) $\text{S} + \text{conc. HNO}_3 \rightarrow$
- (ii) $\text{C} + \text{conc. H}_2\text{SO}_4 \rightarrow$
- (iii) $\text{Cu} + \text{dil. HNO}_3 \rightarrow$

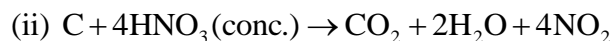
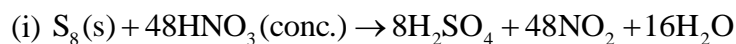
(b) Write a balanced chemical equation for the preparation of [3]

- (i) Ethene from bromoethane
- (ii) Ethyne using calcium carbide
- (iii) Methane from sodium acetate

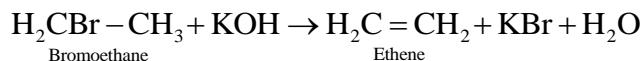
(c) Name the following organic compounds: [4]

- (i) The compound with 3 carbon atoms whose functional group is carboxyl.
- (ii) The first homologue whose general formula is C_nH_{2n} .
- (iii) The compound that reacts with acetic acid to form ethyl ethanoate.
- (iv) The compound formed by complete chlorination of ethyne.

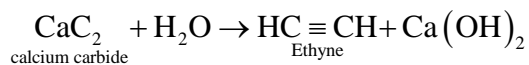
Solution 4:



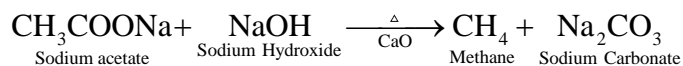
(b) (i) Ethene from bromoethane



(ii) Ethyne using calcium carbide



(iii) Methane from Sodium acetate



(c) (i) Propanoic acid

(ii) Ethene

(iii) Ethanol

(iv) Acetylene tetrachloride

Question 5

(a) Give the chemical formula of [3]

(i) Bauxite

(ii) Cryolite

(iii) Sodium aluminate

(b) Answer the following question based on the extraction of aluminium from alumina by **Hall-Heroult's process**: [3]

(i) What is the function of cryolite used along with alumina as the electrolyte?

(ii) Why is powdered coke sprinkled on top of the electrolyte?

(iii) Name the electrode from which aluminium is collected.

(c) Match the alloys given in column I to the uses given in column II. [4]

COLUMN I	COLUMN II
(i) Duralumin	A. Electrical fuse
(ii) Solder	B. Surgical instruments
(iii) Brass	C. Aircraft body
(iv) Stainless steel	D. Decorative articles

Solution 5:

(a) Chemical formula of

(i) Bauxite: $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$

(ii) Cryolite: Na_3AlF_6

(iii) Sodium aluminate: NaAlO_2

(b)

- (i) Cryolite is mixed with alumina to bring down lowers the fusion temperature from 2050°C to 950°C and enhances conductivity.
- (ii) Powdered coke is sprinkled on top of the electrolyte. It reduces heat loss the melting point of electrolyte mixture and to increase its electrical conductivity.
- (iii) Aluminium is collected at the cathode which is carbon lining covering the inside portion of vessel.

COLUMN I	COLUMN II
(i) Duralumin	Aircraft body
(ii) Solder	Electrical fuse
(iii) Brass	Decorative articles
(iv) Stainless steel	Surgical instruments

Question 6

- (a) Identify the substances underlined: [3]
 (i) The catalyst used to oxidise ammonia.
 (ii) The organic compound which when solidified forms an ice-like mass.
 (iii) The dilute acid which is an oxidising agent.
- (b) Copper sulphate solution reacts with sodium hydroxide solution to form a precipitate of copper hydroxide according to the equation: [3]

$$2\text{NaOH} + \text{CuSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Cu}(\text{OH})_2 \downarrow$$

 (i) What mass of copper hydroxide is precipitated by using 200 gm of sodium hydroxide?
 [H = 1, O = 16, Na = 23, S = 32, Cu = 64]
 (ii) What is the colour of the precipitate formed?
- (c) Find the **empirical formula** and the **molecular formula** of an organic compound from the data given below: [4]
 C = 75.92%, H = 6.32% and N = 17.76%
 The vapour density of the compound is 39.5.
 [C = 12, H = 1, N = 14]

Solution 6:

- (a) (i) Platinum is used as a catalyst to oxidise ammonia.
 (ii) Acetic acid (CH_3COOH)
 (iii) Nitric acid (HNO_3)
- (b) The given equation is

$$2\text{NaOH} + \text{CuSO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{Cu}(\text{OH})_2 \downarrow$$

 (i) Molecular weight of NaOH, Sodium hydroxide = $23 + 16 + 1 = 40$

Molecular weight of $\text{Cu}(\text{OH})_2$,
 Copper hydroxide = $64 + 16 + 1 + 16 + 1 = 98$
 Now, 40g of NaOH is used to precipitate 98g of $\text{Cu}(\text{OH})_2$.

Hence, 200g of NaOH will be used to precipitate $(98/40)200$ g of $\text{Cu(OH)}_2 = 490\text{g}$ of Cu(OH)_2 .
So, 490g of copper hydroxide would be prepared using 200g of sodium hydroxide.

(ii) A light blue precipitate of Cu(OH)_2 will be formed.

(c)

Element	% composition	Atomic mass	Atomic ratio	Simplest ratio
C	75.92	12	$\frac{75.92}{12} = 6.32$	$\frac{6.32}{1.26} = 5$
H	6.32	1	$\frac{6.32}{1} = 6.32$	$\frac{6.32}{1.26} = 5$
N	17.76	14	$\frac{17.76}{14} = 1.26$	$\frac{1.26}{1.26} = 1$

So, the compound has the empirical formula of the compound is $\text{C}_5\text{H}_5\text{N}$.

Now,

Molecular weight = $2 \times$ vapour density

$$= 2 \times 39.5$$

$$= 79$$

So, molecular mass of the given compound is 79.

Thus, empirical formula mass is 79.

Since, Empirical formula mass = molecular mass

Therefore, the molecular formula is $\text{C}_5\text{H}_5\text{N}$.

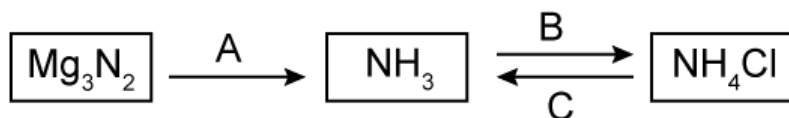
Question 7

(a) Name the gas evolved in each of the following cases. [3]

- Alumina undergoes electrolytic reduction.
- Ethene undergoes hydrogenation reaction.
- Ammonia reacts with heated copper oxide.

(b) Study the flow chart given and give balanced equations to represent the reactions A, B and C:

[3]



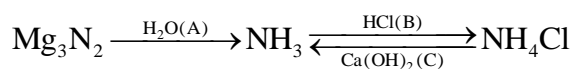
- (c) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [4]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(i) _____	(ii) _____
Sulphuric acid	(iii) _____	(iv) _____

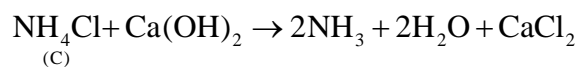
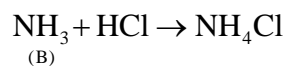
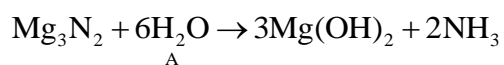
Solution 7:

- (a) (i) Carbon dioxide gas
(ii) Ethane gas
(iii) Nitrogen gas

- (b) The flow chart can be completed as follows:



The full reaction is follows:



- (c) Details of industrial processes-

Name of the compound	Name of the process	Catalytic equation (with the catalyst)

Ammonia	(i) Haber's Process	(ii) $\text{N}_2(\text{g}) + \text{H}_2(\text{g}) \xrightleftharpoons[\text{K}_2\text{O} + \text{Al}_2\text{O}_3]{\text{Iron oxide}} 2\text{NH}_3(\text{g})$ Ammonia
Sulphuric acid	(iii) Contact Process	(iv) $2\text{SO}_2 + \text{O}_2(\text{g}) \xrightarrow{\text{V}_2\text{O}_5} 2\text{SO}_3(\text{g}) \xrightarrow{\text{H}_2\text{SO}_4} \text{H}_2\text{S}_2\text{O}_7$ Oleum

ICSE-2020
Grade 10 Chemistry

Time: 2 hours

Total Marks: 80

Answers to this Paper must be written on the paper provided separately you will not be allowed to write during first 15 minutes. This time is to be spans in reading the question paper.

The time given at the head of this paper is the time allowed for writing the answers.

Section I is compulsory, attempt **any four** question from **Section II** the intended marks for question or parts of question are given in brackets []

SECTION I

Attempt all questions from this Section

Question 1

(a) Choose the correct answer from the options given below:

[5]

- (i) The element with highest ionization potential, is:
 - A. Hydrogen
 - B. Caesium
 - C. Radon
 - D. Helium
- (ii) The inert electrode used in the electrolysis of acidified water, is:

- A. Nickel
- B. Platinum
- C. Copper
- D. Silver

(iii) A compound with low boiling point, is:

- A. Sodium chloride
- B. Calcium chloride
- C. Potassium chloride
- D. Carbon tetrachloride

(iv) The acid which can produce carbon from cane sugar, is:

- A. Concentrated Hydrochloric acid
- B. Concentrated Nitric acid
- C. Concentrated Sulphuric acid
- D. Concentrated Acetic acid

(v) The organic compound having a triple carbon-carbon covalent bond, is:

- A. C_3H_4
- B. C_3H_6
- C. C_3H_8
- D. C_4H_{10}

(b) State one relevant observation for each of the following reactions: [5]

- (i) Action of concentrated nitric acid on copper.
- (ii) Addition of excess ammonium hydroxide into copper sulphate solution.,
- (iii) A piece of sodium metal is put into ethanol at room temperature.

- (iv) Zinc carbonate is heated strongly.
- (v) Sulphide ore is added to a tank containing oil and water, and then stirred or agitated with air.

(c) Write a balanced chemical equation for each of the following: [5]

- (i) Reaction of carbon powder and concentrated nitric acid.
- (ii) Reaction of excess ammonia with chlorine.
- (iii) Reaction of lead nitrate solution with ammonium hydroxide.
- (iv) Producing ethene from bromo ethane using Zn/Cu couple in alcohol.
- (vi) Completed combustion of ethane

(d) (i) Draw the structural formula for each of the following: [5]

- 1. 2,2 dimethyl pentane
- 2. methanol
- 3. Iso propane

(ii) Write the IUPAC name for the following compounds:

- 1. Acetaldehyde
- 2. Acetylene

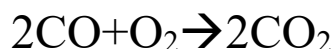
(e) State one relevant reason for each of the following: [5]

- (i) Graphite anode is preferred to platinum in the electrolysis of molten lead bromide.

- (ii) Soda lime is preferred to sodium hydroxide in the laboratory preparation of methane
- (iii) Hydrated copper sulphate crystals turn white on heating.
- (iv) Concentrated nitric acid appears yellow, when it is left for a while in a glass bottle.
- (v) Hydrogen chloride gas fumes in moist air.

(f) Calculate: [5]

- (i) The amount of each reactant required to produce 750 ml of carbon dioxide, when two volumes of carbon monoxide combine with one volume of oxygen to produce two volumes of carbon dioxide.



- (ii) The volume occupied by 80 g of carbon dioxide at STP.
- (iii) Calculate the number of molecules in 4.4 gm of CO_2 [Atomic mass of C- 12, O=16]
- (iv) State the law associated in question no. (f)(i) above.

(g) Give one word or a passage following statement: [5]

- (i) The chemical bond formed by a shared pair of electrons. Each bonding atom contributing one electron to the pair
- (ii) Electrode used as a cathode in electrorefining of impure copper.

- (iii) The substance prepared by adding other metals to a base metal appropriate proportions to obtain certain desirable properties.
- (iv) The tendency of an atom to attract electrons to itself when combined in a compound.
- (v) the reaction in which carboxylic acid reacts with alcohol in the presence of conc H_2SO_4 to form a substance having a fruity smell.

(h) Fill in the blanks from the choices given in brackets: [5]

- (i) The polar covalent compound in gaseous state that does not conduct electricity is _____
(carbon tetra chloride, ammonia, methane)
- (ii) A salt prepared by displacement reaction is _____ (ferric chloride, ferrous chloride, silver chloride)
- (iii) The number of moles in 11 gm of nitrogen gas is _____ (0.39, 0.49, 0.29) [atomic mass of N=14]
- (iv) An alkali which completely dissociates into ions is _____ (ammonium hydroxide, calcium hydroxide, lithium hydroxide)
- (v) An alloy used to make statues is _____
(bronze, brass, fuse metal)

SECTION II

Attempt any four questions from this Section

Question 2

- (a) The following table represent the elements and the atomic number. With reference to this, answer the following using only the alphabets given in the table. [3]

Element	Atomic number
P	13
Q	7
R	10

- (i) Which element combines with hydrogen to form a basic gas?
 - (ii) Which element has an electron affinity zero?
 - (iii) Name the element, which forms an ionic compound with chlorine.
- (b) Draw the electron dot diagram for the compounds given below. Represent the electrons by (.) and (x) in the diagram. [Atomic No.: Ca = 20, O= 8, Cl= 17, H=1] [3]
- (i) Calcium oxide
 - (ii) Chlorine molecule
 - (iii) Water molecule

- (c) Choose the correct word which refers to the process of electrolysis from A to E. to match the description (i) to (iv) A: Oxidation B: Cathode C: Anode D: An electrolyte E: Reduction [4]
- (i) Conducts electricity in aqueous or in molten state.
 - (ii) Loss of electron takes place at anode.
 - (iii) A reducing electrode.
 - (iv) Electrode connected to the positive end or terminal of the battery.

Question 3

- (a) Baeyer's process is used to concentrate bauxite ore to alumina. Give balanced chemical equations for the reaction taking place for its conversion from bauxite to alumina. [3]
- (b) Complete the following by selecting the correct option from the choices given: [3]
 - (i) pH of acetic acid is greater than dilute Sulphuric acid. So acetic acid contains _____ concentration of H^+ ions. (greater, same, low)
 - (ii) The indicator which does not change colour on passage of I- ICl_3 gas is _____. (methyl orange, moist blue litmus, phenolphthalein)
 - (iii) The acid which cannot act as an oxidizing agent is (conc. H_2SO_4 , conc. HNO_3 , conc. HCl)
- (c) Match the gases given in column I to the identification of the gases mentioned in column II [4]

Column I	Column II
(i) Hydrogen sulphide	A. Turns acidified potassium dichromate solution green.
(ii) Nitric oxide	B Turns lime water milky
(iii) Carbon dioxide	C Turns reddish brown when it reacts with oxygen.
(iv) Sulphur dioxide	D Turns moist lead acetate paper silvery black.

Question 4

(a) Differentiate between the following pairs based on the information given in the brackets. [3]

- (i) Conductor and electrolyte (conducting particles)
- (ii) Cations and anions (formation from an atom)
- (iii) Acid and Alkali (formation of type of ions)

(b) Draw the structures of isomers of pentane. [3]

(c) Hydrogen chloride gas is prepared in the laboratory using concentrated sulphuric acid and sodium chloride.

Answer the questions that follow based on this reaction:

[4]

- (i) Give the balanced chemical equation for the reaction with suitable condition (s) if any.
- (ii) Why is concentrated sulphuric acid used instead of concentrated nitric acid?

- (iii) How is the gas collected?
- (iv) Name the drying agent not used for drying the gas.

Question 5

- (a) Distinguish between the following pairs of compounds using a reagent as a chemical test: [3]
 - (i) Calcium nitrate and Zinc nitrate solution.
 - (ii) Ammonium sulphate crystals and Sodium sulphate crystals.
 - (iii) Magnesium chloride and Magnesium nitrate solution.
- (b) Calculate the percentage of: [3]
 - (i) Fluorine
 - (ii) Sodium and
 - (iii) Aluminium

in sodium aluminium fluoride $[\text{Na}_3\text{AlF}_6]$, to the nearest whole number. [Atomic Mass: Na = 23, Al = 27, F = 19]
- (c)
 - (i) State the volume occupied by 40 gm of methane at STP, if its vapour density (V.D.) is 8. [4]
 - (ii) Calculate the number of moles present in 160 gm of NaOH. [Atomic Mass: Na = 23, H = 1, O = 16]

Question 6

- (a) Identify the salts P, Q, R from the following observations: [3]
- (i) Salt P has light bluish green colour. On heating, it produces a black coloured residue. Salt P produces brisk effervescence with dil. HCl and the gas evolved turns lime water milky, but no action with acidified potassium dichromate solution.
 - (ii) Salt Q is white in colour. On strong heating, it produces buff yellow residue and liberates reddish brown gas. Solution of salt Q produces chalky white insoluble precipitate with excess of ammonium hydroxide.
 - (iii) Salt R is black in colour. On reacting with concentrated HCl, it liberates a pungent greenish yellow gas which turns moist starch iodide paper blue black.
- (b) Identify the substance underlined in each of the following: [3]
- (i) The electrode that increases in mass during the electro-refining of silver.
 - (ii) The acid that is a dehydrating as well as a drying agent.
 - (iii) The catalyst used to oxidize ammonia into nitric oxide.
- (c) Copy and complete the following paragraph using the options given in brackets: [4]

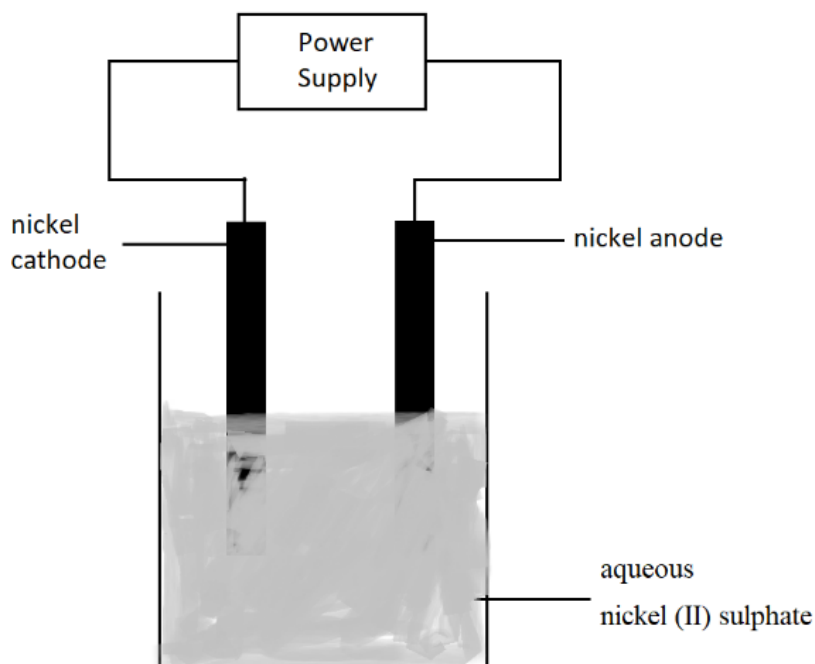
Alkenes are a homologous series of (i) _____ (saturated / unsaturated) hydrocarbons characterized by the general formula (ii) (C_nH_{2n+2} / C_nH_{2n}). Alkenes undergo (iii) _____ (addition substitution) reactions and also undergo (iv) _____ (hydrogenation / dehydrogenation) to form alkanes.

Question 7

- (a) Write balanced chemical equations, for the preparation of the given salts (i) to (iii) by using the methods A to C respectively: [3]

A: Neutralization B: Precipitation C: Titration

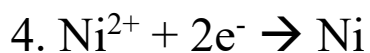
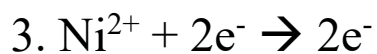
- (i) Copper sulphate
 - (i) .(ii) Zinc carbonate
 - (ii) Ammonium sulphate
- (b) Name the following elements: [3]
- (i) An alkaline earth metal present in group 2 and period 3.
 - (ii) A trivalent metal used to make light tools.
 - (iii) A monovalent non-metal present in fluorspar.
- (c) An aqueous solution of nickel (II) sulphate was electrolyzed using nickel electrodes. Observe the diagram and answer the questions that follow: [4]



(i) What do you observe at the cathode and anode respectively?

(ii) Name the cation that remains as a spectator ion in the solution.

(iii) Which equation for the reaction at the anode is correct?



**ICSE Board
Class X Chemistry
Science Paper – II
Semester 1 Examination
Board Paper – 2021**

Time: 1 hour

Maximum Marks: 40

Maximum Marks: 40

Time allowed: one hour

You will not be allowed to write during the first 10 minutes.

This time is to be spent in reading the question paper.

ALL QUESTIONS ARE COMPULSORY

The intended marks for questions or parts of questions are given in brackets [].

Select the correct option for each of the following questions.

Question 1

In the periodic Table, elements of period 3 are arranged in the increasing order of ionization potential as: [1]

- (a) B, N, Cl, Ar
- (b) Mg, Si, S, Ar
- (c) Ar, Si, S, Mg
- (d) Si, Ar, Cl, Mg

Question 2

If Relative Molecular Mass of Butane (C_4H_{10}) is 58 then its vapour density will be: [1]

- (a) 58
- (b) 29
- (c) 32
- (d) 16

Question 3

Identify one statement that holds true for electrolysis of molten lead bromide: [1]

- (a) Silver grey metal deposits at the anode
- (b) Temperature is not maintained during the electrolysis
- (c) Brown vapours of bromine are obtained at the anode.
- (d) Electrolyte contains H^+ ions along with Pb^{2+} ions

Question 4

The tendency of an atom to attract shared pair of electrons to itself when forming a chemical bond is known as: [1]

- (a) Electron affinity
- (b) Electronegativity
- (c) Ionization potential
- (d) Nuclear charge

Question 5

Solid sodium chloride **does not** conduct electricity as: [1]

- (a) The strength of the bond is weak
- (b) It contains free ions
- (c) It does not contain any free ions
- (d) It contains free ions as well as molecules

Question 6

Elements A and B have electronic configurations 8 and 13 respectively. The chemical formula formed between A and B will be: [1]

- (a) AB
- (b) B₃A₃
- (c) A₂B₃
- (d) B₂A₃

Question 7

The percentage of hydrogen present in NaOH is: (Relative Molecular Mass of NaOH = 40) (At. Wt. of H = 1) [1]

- (a) 2.5
- (b) 25
- (c) 0.25
- (d) 0.025

Question 8

A salt formed by incomplete neutralization of an acid by a base: [1]

- (a) Basic salt
- (b) Acid salt
- (c) Normal salt
- (d) Complex salt

Question 9

The colour of the precipitate formed after the addition of a small amount of sodium hydroxide solution to an aqueous solution of ferric chloride is: [1]

- (a) gelatinous white
- (b) pale blue
- (c) reddish brown
- (d) dirty green

Question 10

Alkaline earth metals have the same: [1]

- (a) number of valence electrons
- (b) number of shells
- (c) metallic property
- (d) ionization potential

Question 11

Which of the following compounds neither dissociate nor ionise in water? [1]

- (a) Hydrochloric acid
- (b) Sodium hydroxide
- (c) Potassium Nitrate
- (d) Carbon tetrachloride

Question 12

The table shows the electronic configuration of four elements. [1]

element	electronic configuration
W	2, 6
X	2, 8
Y	2, 8, 1
Z	2, 8, 7

Which pair of atoms will form a covalent compound?

- (a) two atoms of W
- (b) two atoms of X
- (c) an atom of W and an atom of X
- (d) an atom of Y and an atom of Z

Question 13

Element with an atomic number 19 will: [1]

- (a) accept an electron and get oxidized
- (b) accept an electron and get reduced
- (c) lose an electron and get oxidized
- (d) lose an electron and get reduced

Question 14

Which of the following has two sets of lone pair of electrons in them? [1]

- (a) Ammonia
- (b) Methane
- (c) Water
- (d) Ammonium ion

Question 15

If the empirical mass of the formula PQ_2 is 10 and the Relative Molecular Mass is 30, then the molecular formula will be: [1]

- (a) PQ_2
- (b) P_3Q_2
- (c) P_6Q_2
- (d) P_3Q_6

Question 16

Which of the following is a tribasic acid?

[1]

- (a) H_2SO_4
- (b) $\text{Al}(\text{OH})_3$
- (c) H_3PO_4
- (d) $\text{Ca}(\text{OH})_2$

Question 17

If a solution of an electrolyte mixture has calcium ions, cupric ions, zinc ions and magnesium ions, which of these ions would you see preferentially discharged at the cathode?

[1]

- (a) Calcium ions
- (b) Zinc ions
- (c) Cupric ions
- (d) Magnesium ions

Question 18

Which of the following ions will readily discharge at the anode during the electrolysis of acidulated water?

[1]

- (a) OH^-
- (b) SO_4^{2-}
- (c) Cl^-
- (d) H^+

Question 19

If the empirical formula of a compound is CH and its vapour density is 13, then its molecular formula will be:

[1]

- (At. Wt. $\text{C}=12$, $\text{H}=1$)
- (a) CH
 - (b) C_2H_2
 - (c) C_4H_4
 - (d) C_3H_3

Question 20

Aqueous solution of Cupric chloride forms a deep blue solution on addition of:

[1]

- (a) dropwise sodium hydroxide
- (b) excess sodium hydroxide
- (c) dropwise ammonium hydroxide
- (d) excess ammonium hydroxide

Question 21

Which statement about conduction of electricity is correct?

[1]

- (a) Electricity is conducted in aqueous solution by electrons
- (b) Electricity is conducted in a metal wire by ions
- (c) Electricity is conducted in a molten electrolyte by electrons
- (d) Electricity is conducted in an acid solution by ions

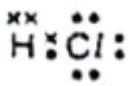
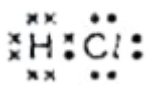
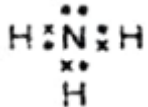
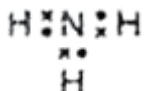
Question 22

If an element has low ionization potential, then it is likely to be a: [1]

- (a) metal
- (b) metalloid
- (c) non metal
- (d) inert gas

Question 23

Which electron arrangement for the outer shell electrons in a covalent compound is correct? [1]

- (a) 
- (b) 
- (c) 
- (d) 

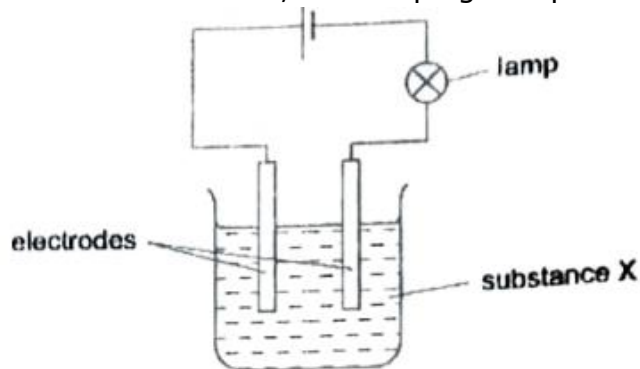
Question 24

The products formed when an acid reacts with a base is: [1]

- (a) salt and hydrogen
- (b) salt and oxygen
- (c) salt and water
- (d) salt and carbon dioxide

Question 25

In the circuit below, the lamp lights up. [1]



What could X be?

- (a) a solution of alcohol in water
- (b) a solution of sodium chloride in water
- (c) sugar solution
- (d) solid potassium chloride

Question 26

Which one of the following is a non-metallic cation?

[1]

- (a) K^+
- (b) NH_4^+
- (c) Cu^{2+}
- (d) Na^+

Question 27

Type of bonding present in hydrogen chloride:

[1]

- (a) metallic
- (b) ionic
- (c) covalent
- (d) coordinate

Question 28

The non-metallic properties of elements from left to right in a Periodic Table:

[1]

- (a) increases
- (b) decreases
- (c) remains same
- (d) first increases and then decreases

Question 29

The aqueous solution that contains both ions and molecules:

[1]

- (a) sulphuric acid
- (b) nitric acid
- (c) acetic acid
- (d) hydrochloric acid

Question 30

The basic oxide which is an alkali:

[1]

- (a) Copper oxide
- (b) Sodium oxide
- (c) Ferric oxide
- (d) Zinc oxide

Question 31

If the pH of a solution is '2', then solution is a:

[1]

- (a) strong acid
- (b) strong alkali
- (c) weak acid
- (d) weak alkali

Question 32

The acidity of aluminium hydroxide is:

[1]

- (a) 3
- (b) 1
- (c) 4
- (d) 2

Question 33

Hydracids are those acids which contain:

[1]

- (a) Hydrogen with any metal
- (b) Hydrogen, a non-metal and oxygen
- (c) Hydrogen and a non-metal other than oxygen
- (d) Hydrogen and oxygen only

Question 34

The oxidation reaction among the following is:

[1]

- (a) $\text{Fe}^{3+} + 3\text{e}^- \rightarrow \text{Fe}$
- (b) $\text{Fe}^{2+} - \text{Ie}^- \rightarrow \text{Fe}^{3+}$
- (c) $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^{1-}$
- (d) $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

Question 35

A student added excess of sodium hydroxide solution to each of the salt solution. An insoluble precipitate formed was observed in:

[1]

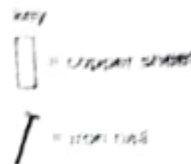
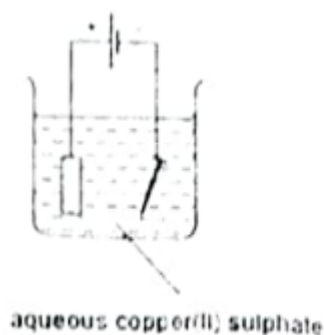
- (a) Calcium nitrate
- (b) Zinc nitrate
- (c) Lead nitrate
- (d) Sodium nitrate

Question 36

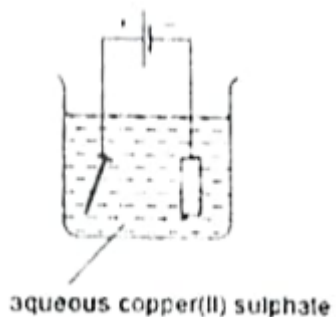
Which apparatus could be used to electroplate an iron nail with copper?

[1]

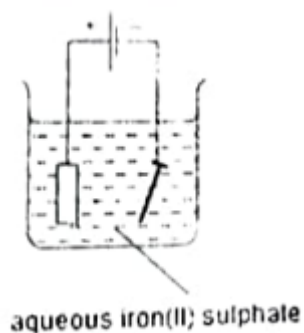
- (a)



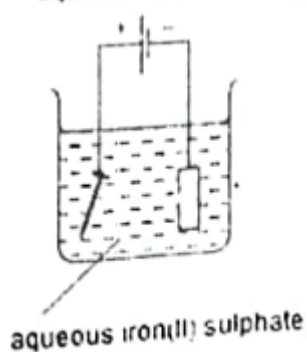
(b)



(c)



(d)



Question 37

The table below shows the electronic arrangements of six atoms, A to F.

atom	A	B	C	D	E	F
electronic configuration	2, 5	2	2, 6	2, 8, 6	2, 8, 8	2, 8, 3

With respect to the table select the following:

(i) Two atoms from the same group of the periodic table: [1]

- (a) D and E
- (b) C and D
- (c) E and F
- (d) C and E

(ii) Two noble gases: [1]

- (a) A and B
- (b) E and F
- (c) B and E
- (d) D and E

(iii) The atom which is the most electronegative: [1]

- (a) A
- (b) B
- (c) C
- (d) F

(iv) The atom which has the highest ionization potential: [1]

- (a) A
- (b) B
- (c) E
- (d) F

Solution

Solution 1-(b) Ionization potential increases from left to right in a periodic table.

Solution 2-(b)
$$\text{Vapour Density} = \frac{\text{Molar Mass}}{2} = \frac{58}{2} = 29$$

Solution 3-(c) In electrolysis of molten lead bromide, brown vapours of bromine are obtained at anode.

Solution 4-(b) The tendency of an atom to attract shared pair of electrons to itself when forming a chemical bond is known as electronegativity.

Solution 5-(c) Solid NaCl does not contain electricity it does not contain electricity.

Solution 6-(d) Electronic configuration of A- 2, 6

Electronic configuration of B- 2, 8, 3

A required to gain 2 electrons to complete its octet so valency of A=-2

B required to donate 3 electrons to complete its octet so valency of B=+3

B is cation and A is anion so by using crisscross method in ionic compounds.

Chemical formula will be B_2A_3 .

Solution 7-(a)

$$\% \text{ of H} = \frac{\text{Atomic mass of H}}{\text{Molar mass of NaOH}} = \frac{1}{23 + 16 + 1} \times 100 = \frac{100}{40} = 2.5\%$$

Solution 8-(b) A salt that is formed by incomplete neutralization of acid is acidic salt.

Solution 9-(c) $Fe(OH)_3$ precipitate formed after the addition of a small amount of sodium hydroxide solution to an aqueous solution of ferric chloride. $Fe(OH)_3$ is brown in colour.

Solution 10-(a) Alkaline earth metals are present in same group so they have same number of valence electrons.

Solution 11-(d) Carbon tetrachloride is covalent compound. So it neither dissociate nor ionise in water

Solution 12-(a) Two atoms of W will share 2-2 electrons to form covalent compound and become stable.

Solution 13-(C) After losing one electron, it will have electronic configuration of inert gas. So it will lose one electron and losing electron is oxidation process.

Solution 14-(c) Water molecule is having two lone pairs in molecule.

Solution 15-(d)

Molecular Formula = Empirical formula \times n

$$n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}}$$

$$n = \frac{30}{10} = 3$$

$$\text{Molecular formula} = 3 \times (\text{PQ}_2) = \text{P}_3\text{Q}_6$$

Solution 16-(c) H_3PO_4 is tribasic acid because it can donate 3 H^+ ions.

Solution 17-(C) Cupric ion preferentially discharged at the cathode due to its high mobility.

Solution 18-(a) OH^- ions will readily discharge at the anode during the electrolysis of acidulated water.

Solution 19-(b)

Molar mass = Vapour density \times 2

$$= 13 \times 2 = 26$$

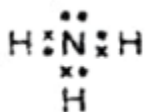
Molar mass of C_2H_2 is 26.

Solution 20-(d) Aqueous solution of Cupric chloride forms a deep blue solution on addition of excess ammonium hydroxide

Solution 21-(d) Electricity is conducted in an acid solution by ions

Solution 22-(a) Metals have low ionization potential.

Solution 23-(c) Following structure is following octet and duplet rule.



Solution 24-(c) When acid reacts with base, Salt and water is formed.

Solution 25-(b)

In the circuit below, the lamp lights up then X should be an Ionic compound.

Solution 26-(b) Ammonium ion is non-metallic.

Solution 27-(c) Bonding present in non-metal and non-metal is covalent.

Solution 28-(a) The non-metallic properties of elements from left to right in a Periodic Table increases.

Solution 29-(c) Acetic acid contains both ions and solution because it is a weak electrolyte.

Solution 30-(b) Metallic oxides are alkaline in nature.

Solution 31-(a) $\text{pH}=2$, that means solution is strong acid.

Solution 32-(a) Aluminium hydroxide can donate 3 OH ions s, acidity is 3.

Solution 33-(c) Hydracids are those acids which contain Hydrogen and a non-metal other than oxygen.

Solution 34-(b) Loss of electrons is oxidation.

Solution 35-(a) An insoluble precipitate formed was observed in Calcium nitrate because it forms $\text{Ca}(\text{OH})_2$.

Solution 36-(a) First apparatus is having correct combination of anode-cathode with battery.

Solution 37

- (i) (b) Elements which have same number of outermost electrons are present in same group.
- (ii) (c) Element which have complete duplet or octet are inert gases.
- (iii) (c) Valency of C is -2. (It can accept 2 electrons to complete its octet).
- (iv) (b) B is He which is inert gas so it will have highest ionization potential.

ICSE Chemistry Sem-2 Answer Key 2022, Solved Board Question Paper,

Board	ICSE
Class	10th (X)
Subject	Chemistry
Topic	Solutions of Board Question Paper
Syllabus	on bifurcated syllabus (after reduction)
session	2021-22
Question Type	MCQ (Sec- A) and Descriptive (Sec-B)
Exam	Sem-2
Max mark	40

Section A

(Attempt all questions from this section)

Question 1:

Choose the correct answers to the questions from the given options. (Do not copy the question. Write the correct answer only.)

(i) The ore of aluminium is:

- (a) Calamine
- (b) Haematite
- (c) Magnetite
- (d) Cryolite

Answer: (d) Cryolite

(ii) Hydrogen chloride gas is not collected over water, as:

- (a) It is highly soluble in water.
- (b) It is less soluble in water
- (c) It is lighter than air.
- (d) It is heavier than air.

Answer: (a) It is highly soluble in water.

(iii) An aqueous solution of ammonia is

- (a) Neutral
- (b) Acidic
- (c) Basic
- (d) Amphoteric

Answer: (c) Basic

(iv) The acid which is least volatile is:

- (a) Hydrochloric acid
- (b) Nitric acid
- (c) Dilute sulphuric acid
- (d) Concentrated sulphuric acid

Answer: (d) Concentrated sulphuric acid

(v) The gas formed, when calcium bisulphite reacts with dilute HNO_3 :

- (a) Sulphur trioxide
- (b) Hydrogen
- (c) Sulphur dioxide
- (d) Hydrogen sulphide

Answer: (c) Sulphur dioxide

(vi) The IUPAC name of formic acid:

- (a) Propanoic acid
- (b) Methanoic acid
- (c) Ethanoic acid
- (d) Butanoic acid

Answer: (b) Methanoic acid

(vii) The metallic oxide which when reacts with HCl forms salt and water

- (a) Carbon monoxide
- (b) Nitrous oxide
- (c) Ammonium hydroxide
- (d) Sodium oxide

Answer: (d) Sodium oxide

(viii) Vanadium pentoxide is used as a catalyst in the preparation of:

- (a) Nitrogen gas
- (b) Nitrogen dioxide gas
- (c) Sulphur trioxide gas
- (d) Carbon dioxide gas

Answer: (c) Sulphur trioxide gas

(ix) The catalyst used for the conversion of ethene to ethane:

- (a) Iron
- (b) Nickel
- (c) Cobalt
- (d) Molybdenum

Answer: (b) Nickel

(x) Substance which helps to lower the fusion point of the mixture in the Hall Heroult Process:

- (a) Coke
- (b) Concentrated sodium hydroxide
- (c) Fluorspar
- (d) Concentrated potassium hydroxide

Answer: (c) Fluorspar

Section B

(Attempt any three questions from this section)

Question 2:

(i) Define:

(a) Isomerism

Answer:

The phenomenon in which more than one compounds have the same chemical formula but different chemical structures is called isomerism. Chemical compounds that have identical chemical formulae but differ in properties and the arrangement of atoms in the molecule are called **isomers**. Therefore, the compounds that exhibit **isomerism** are known as **isomers**.

(b) Ores

Answer:

Ores are a **mixture of minerals** processed to produce an industrial mineral or chemically treated to produce one or more metals. The steel, aluminum, chromium, zinc, mercury, manganese, tungsten, and some copper ores are typically processed for just one element.

(ii) Name the following :

(a) The property by which carbon links with itself to form a long chain.

Answer: Catenation

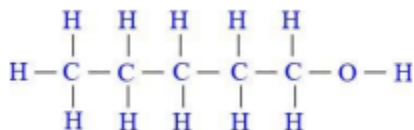
(b) The saturated hydrocarbon having general formula C_nH_{2n-2} .

Answer: Alkyne

(iii) Draw the structural diagram of:

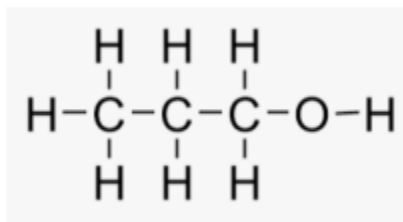
(a) Pentanal

Answer:



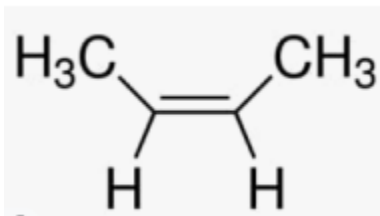
(b) Propanol

Answer:

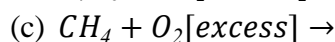
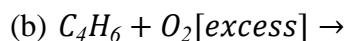
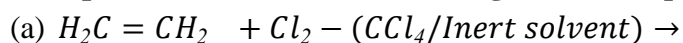


(c) 2- butene

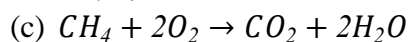
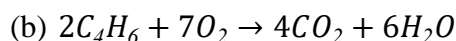
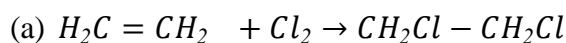
Answer:



(iv) Complete and balance the following chemical equations:



Answer:



Question 3 :

(i) State the following :

(a) A compound formed when excess ammonia gas reacts with chlorine.

Answer:

Ammonia and chlorine gas react to give **ammonium chloride** and nitrogen gas

(b) A substance added to water, to manufacture sulphuric acid in the Contact process.

Answer:

Vanadium pentoxide

(ii) Identity the gas P and Q in the reactions given below:

(a) A compound reacts with an acid to form gas P which has no effect on acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution but turns lime water milky.

Answer:

P is CO_2

(b) A metallic nitrate reacts on heating gives oxygen gas along with a coloured gas Q.

Answer:

Q is NO_2

(iii) State the observation for the following :

(a) Dry ammonia gas reacts with oxygen in the presence of a catalyst.

Answer:

Reddish brown vapours of nitrogen dioxide are seen in the flask due to the oxidation of nitric oxide.

(b) Excess chlorine gas reacts with ammonia gas.

Answer:

A yellow coloured highly explosive liquid.

(c) Carbon reacts with hot concentrated nitric acid.

Answer:

Form carbon dioxide, nitrogen dioxide and water.

(iv) Write balanced equation for the following conversions:

(a) Carbon from cane sugar and concentrated sulphuric acid.

Answer:

$C_{12}H_{22}O_{11}$ (sugar) + H_2SO_4 (sulfuric acid) \rightarrow 12 C (carbon) + 11 H_2O (water) + mixture of water and acid

(b) Ferric nitrate from ferric hydroxide and nitric acid.

Answer:

$Fe(OH)_3 + 3HNO_3 \rightarrow Fe(NO_3)_3 + 3H_2O$.

(c) Ammonium sulphate from ammonium hydroxide and sulphuric acid.

Answer:

$2NH_4OH + H_2SO_4 \rightarrow (NH_4)_2SO_4 + 2H_2O$.

Question 4 :

(i) State the relevant reason for the following:

(a) Concentrated alkali is used for the concentration of bauxite ore.

Answer:

Because it causes soluble sodium meta aluminate and impurities remain insoluble.

(b) Fused alumina is reduced to aluminum by electrolysis.

Answer:

Since Alumina is highly stable.

(ii) State one use of the given alloys:

(a) Magnalium

Answer: Aircraft parts

(b) Duralumin

Answer: Truck wheels, screw machine products,

(iii) Complete the table given below which refers to the laboratory preparation of ammonia gas:

Laboratory preparation	Reactants used	Products formed	Drying agent	Method of collection
Ammonia gas	(a) _____	Calcium chloride + water + ammonia	(b) _____	(c) _____

Answer:

(a) Reactants: Ammonium chloride (NH_4Cl) and calcium hydroxide [$\text{Ca}(\text{OH})_2$], (b) fresh quicklime or soda lime, (c) in an inverted dry gas jar by the downward displacement of air.

(iv) identify the terms for the following:

(a) The process used to purify Alumina by electrolytic reduction.

Answer: Heroult process

(b) The experiment used to demonstrate the high solubility of HCl gas.

Answer: Fountain experiment

(c) The chemical property of sulphuric acid forms two types of salts with an alkali.

Answer: Dibasic.

Question 5:

(i) Write the balanced chemical equation for the following:

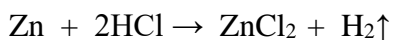
(a) Action of heat on manganese dioxide and concentrated hydrochloric acid.

Answer:



(b) Zinc reacts with dilute hydrochloric acid to form zinc chloride.

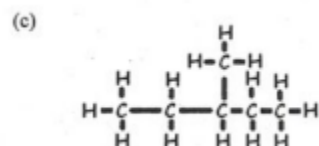
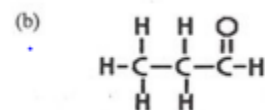
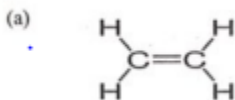
Answer:



(ii) Select the right answer from the brackets and complete the statements:

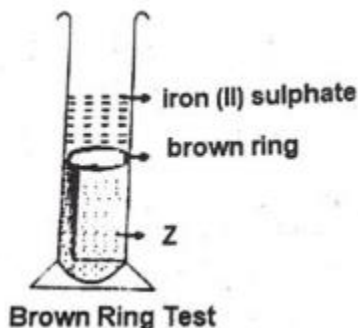
In electrolysis of fused alumina, the anode is made of (a) ..graphite [gas carbon/graphite] and the product formed at cathode is (b) ..oxygen ... [oxygen / aluminum]/

(iii) Give the IUPAC name for the following :



Answer: a) ethene , b) propanol, c) 3-methyl pentane

(iv) Study the diagram, which shows the brown Ring Test and answer the questions given below:



(a) Which ion is determined by Brown Ring Test?

Answer: Nitrate ion

(b) Why is freshly prepared iron[II] sulphate used in the test?

Answer:

Because on exposure to the atmosphere, it is oxidized to ferric sulphate which will not give the brown ring.

(c) Name the substance Z.

Answer:

Sulphuric acid + nitric acid

Question 6:

(i) Distinguish between the following as directed:

(a) Sodium sulphite solution and sodium sulphate solution.

[using dilute H_2SO_4]

Answer:

Sodium sulphate is dissolved in water and barium chloride solution is added, an insoluble white precipitate of barium sulphate is obtained. Sodium sulphite is warmed with dilute sulphuric acid, a colourless gas with a pungent and suffocating smell is evolved.

(b) Lead salt solution and zinc salt solution.

Answer:

Lead salt gives chalky with precipitates of lead hydroxide with ammonium hydroxide. These precipitates are insoluble in excess. Zinc salt gives gelatinous with precipitates of zinc hydroxide with ammonium hydroxide. These precipitates are soluble in excess

[using NH_4OH solution in excess]

(ii) Give one word for the following statements:

(a) The compounds of various metals found in nature with earthly impurities

Answer:

Minerals

(b) A homogeneous mixture of two or more metals or a metal and a non-metal in specific ratios.

Answer:

An alloy

(iii) Identify the acid in each case:

(a) The acid formed when sulphur reacts with concentrated nitric acid.

Answer:

Sulphuric acid(H_2SO_4)

(b) An acid, which on adding to lead nitrate solution produces a white precipitate which is soluble on heating

Answer:

Sulphonic acid (if insoluble on heating) otherwise question may be wrong

(c) The acid formed when potassium nitrate reacts with a least volatile acid.

Answer:

Form nitric acid

(iv) Match column A with column B:

Name (A)	Functional group (B)
1. Aldehyde	a) -OH
2 Carboxylic acids	b)-CHO
3. Alcohol	c)-COOH

Answer :

Name (A)	Functional group (B)
1. Aldehyde	a) -CHO
2 Carboxylic acids	c)-COOH
3. Alcohol	a) -OH

— End of ICSE Chemistry Sem-2 Answer Key 2022, Solved Board Question Paper :-

**Solution for CHEMISTRY
(SCIENCE PAPER - 2)**

Maximum Marks: 80

Time allowed Two hours

Answers to this Paper must be written on the paper provided separately

You will not be allowed to write during first 15 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Section A is compulsory. Attempt any four questions from Section B.

The intended marks for questions or parts of questions are given in brackets [].

SECTION A (40 Marks)

*(Attempt **all** questions from this **Section.**)*

Question 1

Choose the correct answers to the questions from the given options. [15]

(Do not copy the questions, write the correct answers only.)

(i) An element in period 3, whose electron affinity is zero:

- (a) Neon
- (b) Sulphur
- (c) Sodium
- (d) Argon

Answer: (d)

Argon belongs to period 3. It is an inert element and stable. It neither requires gain nor loss. It has its octet complete and hence it has the zero electron affinity.

(ii) An element with the largest atomic radius among the following is:

- (a) Carbon
- (b) Nitrogen

- (c) Lithium
- (d) Beryllium

Answer: (c)

For the elements belonging to one period, an increase in atomic number results in decrease in atomic radius. Therefore, the effective nuclear charge increases along a period and results in decreasing atomic radii.

So Li has the largest atomic radius.

(iii) The compound that is not an ore of aluminium:

- (a) Cryolite
- (b) Corundum
- (c) Fluorspar
- (d) Bauxite

Answer: (c)

Fluorspar is calcium fluoride having a chemical formula as CaF_2 .

Bauxite - $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$

It is the main source of aluminium. It is composed of mainly aluminium-bearing minerals.

Corundum - Al_2O_3

It is an aluminium oxide. It occurs as a crystal in many colors. Along with aluminium, it contains traces of iron, titanium, vanadium and chromium.

Cryolite - Na_3AlF_6

It is a very rare aluminium halide mineral, which occurs as a colourless to white crystal.

(iv) The vapour density of CH_3OH is (At. Wt. C=12, H=1, O=16)

- (a) 32
- (b) 18
- (c) 16
- (d) 34

Answer: (c)

Molecular mass of methyl alcohol = $(1 \times 12 + 3 \times 1 + 16 \times 1 + 1 \times 1) = 32$

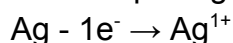
Vapour density = $\frac{\text{Molecular mass}}{2} = \frac{32}{2} = 16$

(v) Which of the following reactions takes place at the anode during the electroplating of an article with silver?

- (a) $\text{Ag} - 1\text{e}^- \rightarrow \text{Ag}^{1+}$
- (b) $\text{Ag} + 1\text{e}^- \rightarrow \text{Ag}^{1-}$
- (c) $\text{Ag} - 1\text{e}^- \rightarrow \text{Ag}$
- (d) None of the above

Answer: (a)

In electroplating with silver, oxidation reaction at anode takes place:



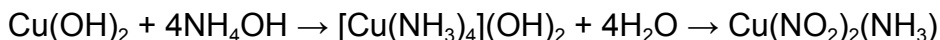
(vi) The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is:

- (a) $\text{Fe}(\text{OH})_2$
- (b) $\text{Cu}(\text{OH})_2$
- (c) $\text{Ca}(\text{OH})_2$
- (d) $\text{Fe}(\text{OH})_3$

Answer: (b)

Copper (II) hydroxide reacts with a solution of excess ammonia to form a deep blue solution of tetraamine copper complex ions. In the presence of oxygen it acts as a catalyst for oxidation of ammonia. It results in forming copper ammine nitrites.

The reaction can be given as,



(vii) An example of a cyclic organic compound is:

- (a) Propene
- (b) Pentene
- (c) Butene
- (d) Benzene

Answer: (d)

From these four options, we can infer that a cyclic unsaturated carbon compound would have ring structure with at least one double or triple bond between the carbon atoms. One such compound is benzene. In benzene, six carbon atoms form a ring structure and there are three single and three double bonds between the carbon atoms. Hence, benzene can be taken as an example of a cyclic unsaturated carbon compound.

(viii) In the laboratory preparation, HCl gas is dried by passing through:

- (a) dilute nitric acid
- (b) concentrated sulphuric acid
- (c) dilute sulphuric acid
- (d) acidified water

Answer: (b)

The hydrogen chloride gas is passed through concentrated sulphuric acid to remove the moisture present in the gas. Due to its hygroscopic nature, concentrated sulphuric acid absorbs moisture from the air, dilutes, and acts as a drying agent. It has a high affinity for water, so it absorbs it quickly.

Thus, sulphuric acid acts as a dehydrating agent.

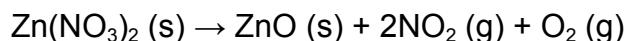
(ix) The nitrate which on thermal decomposition leaves behind a residue which is yellow when hot and white when cold:

- (a) Lead nitrate
- (b) Ammonium nitrate
- (c) Copper nitrate.
- (d) Zinc nitrate

Answer: (d)

Zinc nitrate is a colourless crystalline solid with the chemical formula $\text{Zn}(\text{NO}_3)_2$

When Zinc nitrate decomposes, it produces zinc oxide, a yellow-colored oxide of zinc when hot and white when cold.

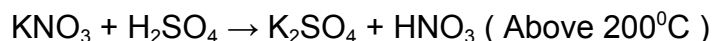
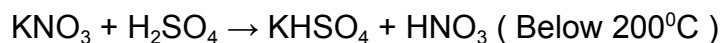


(x) The salt formed when concentrated sulphuric acid reacts with KNO_3 above 200°C :

- (a) K_2SO_4
- (b) K_2SO_3
- (c) KHSO_4
- (d) KHSO_3

Answer: (a)

When concentrated sulphuric acid reacts with KNO_3 above 200°C K_2SO_4 is formed.



(xi)

The property exhibited by concentrated sulphuric acid when it is used to prepare hydrogen chloride gas from potassium chloride:

- (a) Dehydrating property
- (b) Drying property
- (c) Oxidizing property
- (d) Non-volatile acid property

Answer: (d)

Concentrated sulphuric acid has a high boiling point (338°C) and so, it is considered to be a non-volatile acid. It is therefore used for preparing volatile acids like hydrochloric acid, nitric acid and acetic acid from their salts by double decomposition.

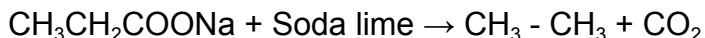
(xii)

The hydrocarbon formed when sodium propanoate and soda lime are heated together:

- (a) Methane
- (b) Ethane
- (c) Ethene
- (d) Propane

Answer: (b)

When sodium propionate is heated with soda lime ethane is formed. This reaction is known as Decarboxylation reaction.



(xiii)

The acid which does not form acid salt by a basic radical:

- (a) H_2CO_3
- (b) H_3PO_4
- (c) H_2SO_4
- (d) CH_3COOH**

Answer: (d)

Acetic acid is a weak acid which does not dissociate completely in water, so it does not form acid salt but forms a normal salt. While in comparison with acetic acid, the other three acids are strong.

(xiv) The general formula of hydrocarbons with single covalent bonds is:

- (a) $\text{C}_n\text{H}_{2n+2}$
- (b) C_nH_{2n}
- (c) $\text{C}_n\text{H}_{2n-2}$
- (d) $\text{C}_n\text{H}_{2n-6}$

Answer: (a)

The general formula of hydrocarbons with single covalent bonds is $\text{C}_n\text{H}_{2n+2}$.

(xv) The indicator which changes to pink colour in an alkaline solution is:

- (a) Blue Litmus
- (b) Methyl Orange
- (c) Red Litmus
- (d) Phenolphthalein**

Answer: (d)

Phenolphthalein produces pink colour in an alkaline solution and colourless in an acidic solution.

Methyl orange changes its colour to yellow in an alkane solution.

Litmus paper turns from red to blue in alkaline solution.

Question 2

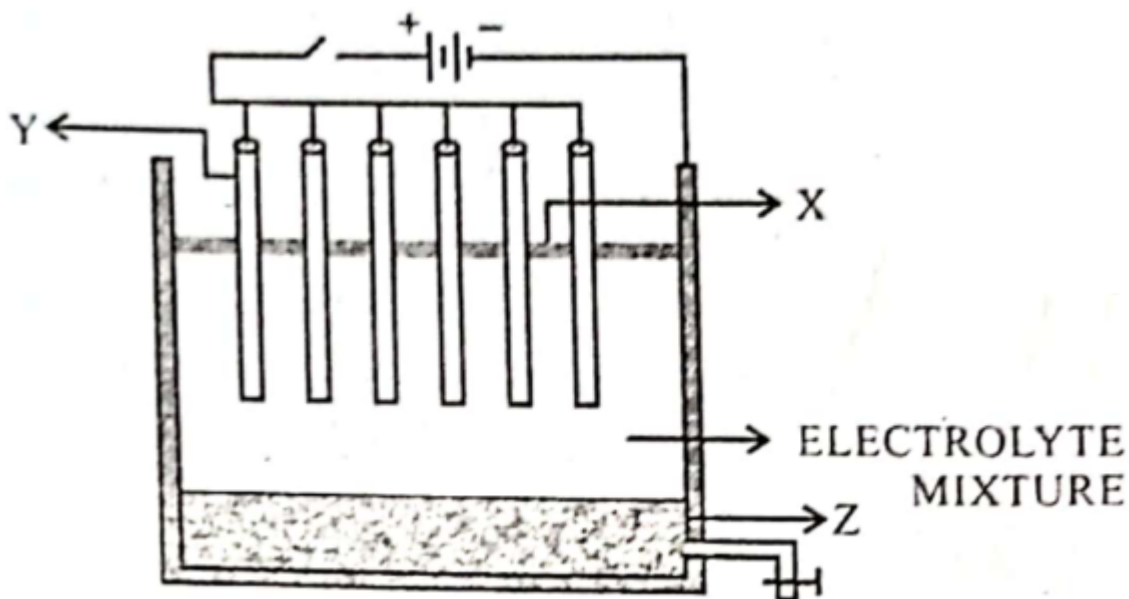
(i) Match the *Column A* with *Column B*:

Column A	Column B
(a) Sodium Chloride	1. Has two shared pair electrons
(b) Methane	2. Has high melting and boiling point
(c) Hydrogen chloride gas	3. A greenhouse gas
(d) Oxidation reaction	4. Has low melting and boiling point
(e) Water	5. $\text{Zn} - 2\text{e}^{-1} \rightarrow \text{Zn}^{2+}$
	6. $\text{S} + 2\text{e}^{-1} \rightarrow \text{S}^{2-}$

Answer:

Column A	Column B
(c) Sodium Chloride	2. Has high melting and boiling point
(d) Methane	3. A greenhouse gas
(c) Hydrogen chloride gas	4. Has low melting and boiling point
(d) Oxidation reaction	5. $\text{Zn} - 2\text{e}^{-} \rightarrow \text{Zn}^{2+}$
(e) Water	1. Has two shared pair electrons

(ii) The following sketch illustrates the process of conversion of **Alumina** to Aluminium:
Study the diagram and answer the following:

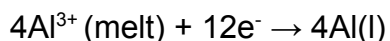


- Name the constituent of the electrolyte mixture which has a divalent metal in it.
- Name the powdered substance 'X' sprinkled on the surface of the electrolyte mixture.
- What is the name of the process?
- Write the reactions taking place at the electrodes 'Y' (anode) and 'Z' (cathode) respectively.

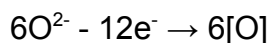
Answer:

- The shown figure are the Hall-Heroult's process, the electrolyte taken in this diagram are - mixture of molten alumina 20%, cryolite 60%, and fluorspar 20%
- Powdered coke is sprinkled on the surface of the electrolyte
- It is Hall-Heroult's process
- The reaction taking place at anode and cathode are—

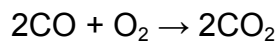
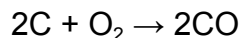
At cathode -



At anode-



Anode is oxidised to carbon monoxide, which further forms carbon dioxide.



(iii) Fill in the blanks with the choices given in the brackets:

(a) Metals are good _____ [oxidizing agents/reducing agents]

(b) Non-polar covalent compounds are _____ [good/bad] conductors of heat and electricity.

(c) Higher the pH value of a solution, the more is _____ [acidic / alkaline] it is.

(d) _____ [Silver chloride / Lead chloride] is a white precipitate that is soluble in excess of Ammonium hydroxide solution.

(e) Conversion of ethene to ethane is an example of _____ [hydrogenation] [hydration/

Answer:

(a) Metals are good reducing agents

metals have low ionization energies and are relatively electropositive, and so they lose electrons easily. Therefore, metals are good reducing agents.

(b) Non-polar covalent compounds are bad conductors of heat and electricity.

Covalent compounds are generally poor conductors of electricity: During the formation of a covalent bond, when the electrons get shared within the bonds, hence, there are no electrons or ions available to conduct electricity.

(c) Higher the pH value of a solution, the more is alkaline it is

The more acidic is a solution, lesser will be its pH . The more alkaline is a solution, the higher will be its pH value.

(d) Silver chloride is a white precipitate that is soluble in excess of Ammonium hydroxide solution.

Observation when Ammonium hydroxide (NH_4OH) is added to Lead salts

1. When Ammonium hydroxide (NH_4OH) is added to Lead salts, a white precipitate is formed which is insoluble in excess of NH_4OH
2. So, the Lead salts are insoluble in excess of NH_4OH

Observation when Ammonium hydroxide (NH_4OH) is added to Silver salts

1. When Ammonium hydroxide (NH_4OH) is added to Silver salts, a white precipitate is formed which is soluble in excess of NH_4OH

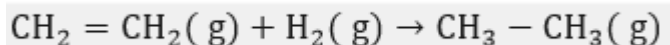


So, Silver salts are soluble in excess of NH_4OH .

(e) Conversion of ethene to ethane is an example of **hydrogenation**

Conversion of Ethene (C_2H_4) to ethane (CH_3CH_3) is an example of Addition of hydrogen or hydrogenation.

When Hydrogen is added to Ethene, in the presence of Nickel or Platinum or Palladium as catalyst at 200°C - 300°C , Ethane is formed.



(iv) **State the terms/process for the following:**

- (a) The energy released when an atom in the gaseous state accepts an electron to form an anion.
- (b) Tendency of an element to form chains of identical atoms.
- (c) The name of the process by which Ammonia is manufactured on a large scale.
- (d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical.
- (e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure.

Answer:

- (a) The energy released when an atom in the gaseous state accepts an electron to form an anion called **electron affinity or electron gain enthalpy**.
- (b) Tendency of an element to form chains of identical atoms are called **catenation**.
- (c) The name of the process by which Ammonia is manufactured on a large scale called Haber's process.
- (d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical is **Basic salt**.
- (e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure is called **Vapour Density**.

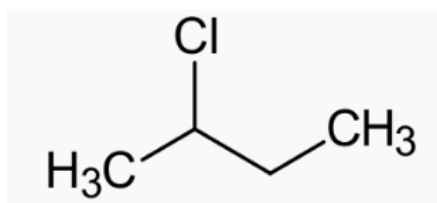
(v)

(a) Give the structural formula of the following organic compounds:

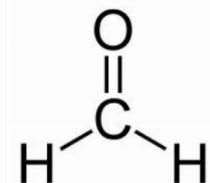
- 1. 2-chlorobutane
- 2. Methanal
- 3. But-2-yne

Answer:

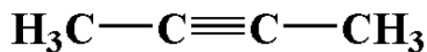
1.



2.

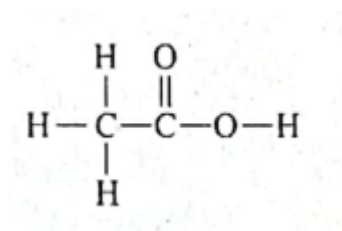


3.

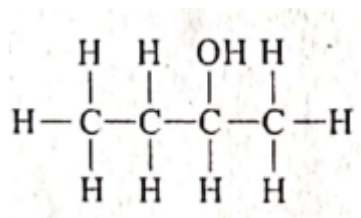


(b) Give the IUPAC name of the following organic compounds:

1.



2.



Answer:

1. Ethanoic acid
2. Butan-2-ol Or 2-butanol.

SECTION - B (40 MARKS)

(Attempt any four questions from this Section.)

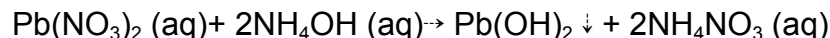
Question 3

(i) Identify the **cation** in each of the following cases:

- (a) Ammonium hydroxide solution when added to Solution B gives a white precipitate which does not dissolve in excess of ammonium hydroxide solution.
- (b) Sodium hydroxide solution when added to Solution C gives a white precipitate which is insoluble in excess of sodium hydroxide solution.

Answer:

When Lead nitrate (Solution B) reacts with ammonium hydroxide(NH_4OH), a white gelatinous precipitate is formed which is insoluble in excess of ammonium hydroxide.

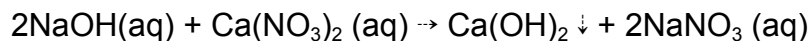


The white gelatinous precipitate is Lead hydroxide which is insoluble in excess of Ammonium hydroxide.

The cation present is Pb^{2+} .

(b) When Sodium hydroxide (NaOH) reacts with Calcium nitrate (Solution C), then a double displacement reaction takes place. Sodium nitrate(NaNO_3) and Calcium

hydroxide(Ca(OH)_2) is formed, out of which Calcium hydroxide precipitates as white precipitate which is insoluble in excess of Sodium hydroxide solution.



The cation present is Ca^{2+} ion.

(ii) Fill in the blanks by choosing the correct answer from the brackets:

(a) During electrolysis, the compound _____ in its molten state liberates reddish brown fumes at the anode. [NaCl/PbBr_2]

(b) The ion which could be discharged most readily during electrolysis is [$\text{Fe}^{2+}/\text{Cu}^{2+}$]

Answer:

(ii)

(a) During electrolysis, the compound **PbBr_2** in its molten state liberates reddish brown fumes at the anode.

(b) The ion which could be discharged most readily during electrolysis is **Cu^{2+}** .

(iii) Arrange the following as per the instruction given in the brackets:

(a) Al, K, Mg, Ca (decreasing order of its reactivity)

(b) N, Be, O, C (increasing order of non-metallic character)

(c) P, Si, F, Be (decreasing order of valence electrons)

Answer:

(a) $\text{K} > \text{Ca} > \text{Mg} > \text{Al}$

(b) $\text{Be} < \text{C} < \text{N} < \text{O}$

(c) $\text{F} > \text{P} > \text{Si} > \text{Be}$

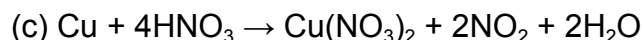
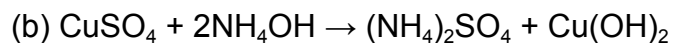
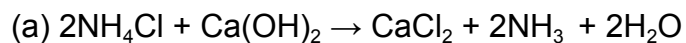
(iv) Complete and balance the following equations:

(a) $\text{NH}_4\text{Cl} + \text{Ca(OH)}_2 \rightarrow$

(b) $\text{CuSO}_4 + \text{NH}_4\text{OH} \rightarrow$

(c) $\text{Cu} + \text{Conc. HNO}_3 \rightarrow$

Answer:



Question 4

(i) State a relevant reason for the following:

(a) Hydrogen chloride gas cannot be dried over quick lime.

(b) Ammonia gas is not collected over water.

Answer:

(i)

(a) We know that Hydrogen chloride is acidic in nature whereas quick lime i.e. Calcium oxide is basic in nature.

If we use Calcium oxide for drying, then both will react to form a salt.

Therefore, quick lime is not used for drying Hydrogen chloride gas.

(b) In the laboratory preparation of ammonia, ammonia is collected by downward displacement of air. Ammonia gas can not be collected over water because this gas is highly soluble in water and due to its high solubility. We are unable to collect it over water.

Ammonia on reaction with water gives hydronium ions and ammonium ions.

Therefore, ammonia is collected over mercury.

(ii) Identify the alloy in each case from the given composition:

(a) aluminium, magnesium, manganese, copper

(b) iron, nickel, chromium, carbon

Answer:

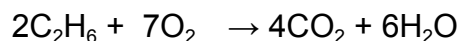
(ii)

(a) Duralumin

(b) Stainless steel

(iii) Solve the following numerical problem.

Ethane burns in oxygen according to the chemical equation:



If 80 ml of ethane is burnt in 300 ml of oxygen, find the composition of the resultant gaseous mixture when measured at room temperature.

Answer:

According to the equation, at room temperature,

- 2 moles of ethane reacts with 7 moles of oxygen to produce 4 moles of carbon dioxide and 6 moles of water.

Therefore,

- 2 mL of ethane reacts with 7 mL of oxygen to produce 4 mL of carbon dioxide and 6 mL of water.

Then,

- 80 mL of ethane reacts with 280 mL of oxygen to produce 160 mL of carbon dioxide and 240 mL of water.

Here, ethane is the limiting reagent and 20 mL of oxygen will be left unreacted.

the composition of the resultant gaseous mixture when measured at room temperature will be:

20 mL of oxygen gas; 160 mL of carbon dioxide and 240 mL of water.

(iv) The following questions are pertaining to the laboratory preparation of Ammonia gas from Magnesium nitride:

(a) Write a balanced chemical equation for its preparation.

(b) Why is this method seldom used?

(c) How do you identify the gas formed?

Answer:

(iv)

(a) $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3$

(b) This method is not used as it is expensive.

(c) Litmus test: Ammonia gas is basic in nature.

It is soluble in water. Its aqueous solution can turn the red litmus paper to blue and no change will be observed if a blue litmus paper is used.

Other tests:

Ammonia gas when brought near Hydrochloric acid, reacts to form dense white fumes of Ammonium chloride.

Question 5

(i) Write one use of the following alloys:

- (a) Bronze
- (b) Fuse metal

Answer:

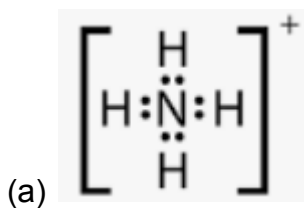
- (a) Bronze is used in making statues.
- (b) Fuse metal is used for Soldering purposes.

(ii) Draw the electron dot structure for the following:

- (a) Ammonium ion
- (b) A molecule of nitrogen

[At. No.: N=7, H=1]

Answer:

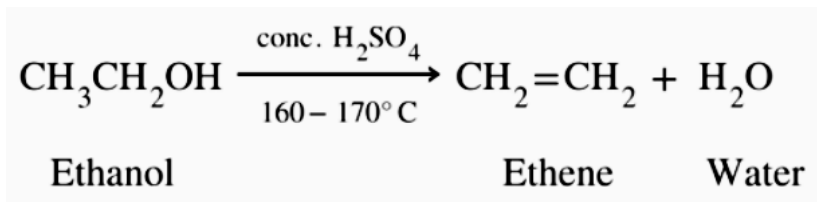


(iii) Give a balanced chemical equation for the following conversions with conditions:

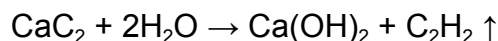
- (a) Ethene from ethanol
- (b) Ethyne from calcium carbide
- (c) Monochloromethane from methane

Answer:

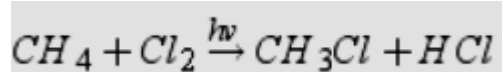
- (a) When concentrated sulphuric acid is added to ethyl alcohol and the mixture is heated upto 170°C, it causes dehydration of ethyl alcohol to give ethene.



- (b) Calcium carbide reacts with water to produce colourless gas (Ethyne gas, C₂H₂) with sweet smelling (ether like odour). This reaction is exothermic.



- (c) Methane reacts with chlorine in diffused sunlight, or when heated to 600 K, to give monochloromethane

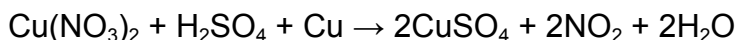


(iv) Study the following observations and name the anions present in each of the reactions.

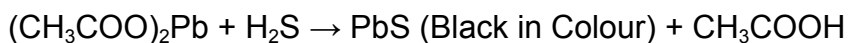
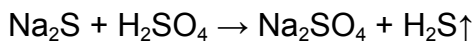
- (a) When a crystalline solid 'P' is warmed with concentrated H₂SO₄ and copper turnings a reddish brown gas is released.
- (b) When few drops of dilute sulphuric acid is added to Salt 'R' and heated, a colourless gas is released which turns moist lead acetate paper silvery black.
- (c) When few drops of barium nitrate solution is added to the salt solution 'Q', a white precipitate is formed which is insoluble in HCl.

Answer:

- (a) Copper nitrate, when warmed with concentrated H₂SO₄ and copper turnings, releases reddish brown gas.



- (b) When a few drops of dilute sulphuric acid are added to Sodium sulphide salt (Na_2S) and heated, Hydrogen sulphide (H_2S), a colourless gas is released which turns moist lead acetate paper silvery black.



- (c) When few drops of barium nitrate solution are added to the Sodium sulphate solution, a white precipitate of Barium Sulphate is formed which is insoluble in HCl. The anion present in salt solution 'Q' is Sulphate ion (SO_4^{2-} ion)

Question 6

(i) Define / State:

- (a) Electronegativity
(b) Gay-Lussac's Law of combining volumes

Answer:

(i)

(a) The tendency of an atom in a molecule to attract the shared pair of electrons towards itself is known as electronegativity.

(b) The law of combining volumes states that when gases react together to form other gases, and when all volumes are measured at the same temperature and pressure. The ratio between the volumes of the reactant gases and the gaseous products can be expressed in simple whole numbers.

(ii)

The Empirical formula of an organic compound is CHCl_2 .

If its relative molecular mass is 168, what is its molecular formula?

(At. Wt. C=12, H = 1, Cl = 35.5]

Answer

(ii)

Empirical formula mass of $\text{CHCl}_2 = 12 + 1 + 35.5 \times 2 = 84 \text{ amu}$

$$\text{Multiplication factor (n)} = \frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{168}{84} = 2$$

Molecular formula = (Empirical Formula)_n = $(\text{CHCl}_2)_2 = \text{C}_2\text{H}_2\text{Cl}_4$

(iii)

Choose the substances given in the box below to answer the following questions:

Iron	Magnesium sulphite	Zinc	Sodium sulphide
Lead	Ferric chloride	Copper	Ferrous sulphate

- (a) The metal that will not produce hydrogen gas when reacted with dilute acids.
- (b) The compound that will produce sulphur dioxide gas when reacted with dilute HCl.
- (c) The solution of this compound produces dirty green precipitate with NaOH.

Answer:

(iii)

- (a) Copper
- (b) Sodium Sulphite
- (c) Ferrous Sulphate

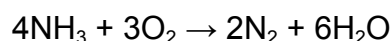
(iv) State one relevant observation for each of the following:

- (a) To the copper nitrate solution, initially few drops of sodium hydroxide solution is added and then added in excess.
- (b) Burning of ammonia in excess of oxygen.
- (c) Dry ammonia gas is passed over heated PbO.

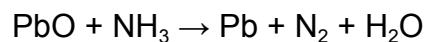
Answer:

(iv)

- (a) When a few drops of sodium hydroxide solution are added to the copper nitrate solution, $\text{Cu}(\text{OH})_2$ light blue colour ppt. is obtained. This is insoluble with excess NaOH
- (b) Ammonia is a combustible gas used in the generation of thermal power. When ammonia reacts with oxygen, it produces nitrogen gas and water.



- (c) Nitrogen gas is produced when dry ammonia gas is passed over heated PbO.



Question 7

(i) Name the following:

- (a) Organic compounds with same molecular formula but different structural formula.
- (b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH₂' group.

Answer:

- (a) Organic compounds with same molecular formula but different structural formula are called **Isomers**.
- (b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH₂' group are known as **Homologous series**.

(ii) Give reason for the following:

- (a) Ionisation potential decreases down a group.
- (b) Ionic compounds do not conduct electricity in solid state.

Answer:

(ii)

- (a) Atomic size increases and the attraction between the valence electron/s and nucleus decreases down the group. This decrease in the attraction between the valence electron/s and nucleus causes the drop in ionization potential down the group.
- (b) Ionic compounds cannot conduct electricity when solid, as their ions are held in fixed positions and cannot move. Ionic compounds are conductors of electricity when molten or in solution, and insulators when solid. But ionic compounds do not conduct electricity in solid state.

(iii)

Calculate:

- (a) The percentage of phosphorus in the fertilizer super phosphate Ca(H₂PO₄)₂ correct to 1 decimal point. [At. Wt. H=1, P=31, O=16, Ca=40]
- (b) Write the empirical formula of C₈H₁₈.

Answer:

(a) Molecular mass of $\text{Ca}(\text{H}_2\text{PO}_4)_2 = 40 + (1 \times 2 + 31 + 16 \times 4) \times 2 = 234 \text{ amu}$

$$\begin{aligned}\text{Percentage of Phosphorus} &= \frac{\text{Mass of phosphorus in one molecule}}{\text{Molecular mass of compound}} \\ &= \frac{62}{234} \times 100 = 26.49\% \text{ or } 26.5\%\end{aligned}$$

(b) Empirical formula for C_8H_{18} is C_4H_9 .

(iv)

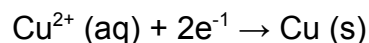
Answer the following questions with reference to electrorefining of copper:

- (a) What is the anode made of?
- (b) What do you observe at the cathode?
- (c) Write the reaction taking place at the cathode.

Answer:

(iv)

- (a) The anode is made of **impure copper**.
- (b) The cathode becomes thicker with time when electrorefining is done. This happens due to the deposition of pure copper over the cathode.
- (c) At the cathode, Copper ions are getting deposited over cathode.



Question 8

(i) Arrange the following according to the instructions given in brackets:

- (a) C_2H_2 , C_3H_6 , CH_4 , C_2H_4 (*In the increasing order of the molecular weight*)
- (b) Cu^{2+} , Na^+ , Zn^{2+} , Ag^+ (*The order of Preferential discharge at the cathode*)

Answer:

- (i) (a) $\text{CH}_4 < \text{C}_2\text{H}_2 < \text{C}_2\text{H}_4 < \text{C}_3\text{H}_6$
- (b) $\text{Na}^+ < \text{Zn}^{2+} < \text{Cu}^{2+} < \text{Ag}^+$

(ii) Differentiate between the following pairs based on the criteria given in the brackets:

- (a) Cane sugar and hydrated copper sulphate [using concentrated H_2SO_4]
- (b) Sulphuric acid and hydrochloric acid [type of salts formed]

Answer:

(ii) (a) **Reaction of concentrated H_2SO_4 with cane sugar:**

- When the concentrated sulphuric acid is poured on the cane sugar, it turns into a spongy mass of carbon. The spongy mass of carbon is called sugar charcoal.
- The concentrated sulphuric acid acts as a dehydrating agent which removes the hydration from the sugar.

Reaction of concentrated H_2SO_4 with hydrated copper sulphate:

- When concentrated Sulphuric acid (H_2SO_4) is added dropwise to the crystals of hydrated Copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), it changes the colour of hydrated copper Sulphate from blue to white.
- H_2SO_4 acts as a dehydrated agent, it removes the water molecule from the compound and forms the anhydrous Copper sulphate which has white colour.

(iii) Convert the following reactions into a balanced chemical equation:

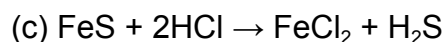
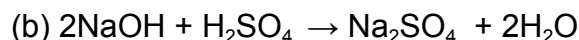
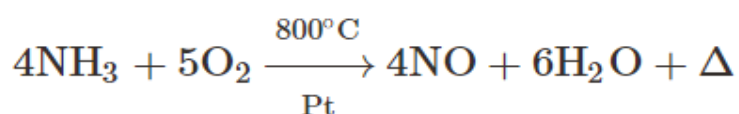
(a) Ammonia to nitric oxide using oxygen and platinum catalyst.

(b) Sodium hydroxide to sodium sulphate using sulphuric acid.

(c) Ferrous sulphide to hydrogen sulphide using hydrochloric acid.

Answer:

(iii) (a)



(iv) Choose the answer from the list which fits in the description:

[CCl_4 , PbO , NaCl , CuO , NH_4Cl]

(a) A compound which undergoes thermal dissociation.

(b) An amphoteric oxide.

(c) A compound which is a non-electrolyte.

Answer:

(iv)

(a) Ammonium chloride(NH_4Cl), a sublimable solid undergoes thermal dissociation on heating and forms ammonia and hydrogen chloride.



(b) Lead (II) oxide can react with acids as well as bases, so it is an amphoteric oxide.

(c) Carbon tetrachloride is a non-electrolyte as it is a Non-polar covalent compound.

Nonelectrolytes are substances that do not conduct electricity in their molten state or when they are dissolved in a solvent.

Chemistry

CISCE

Academic Year: 2023-2024

(English Medium)

Date & Time: 11th March 2024, 11:00 am

Duration: 2h

Marks: 100

1. Answers to this Paper must be written on the paper provided separately.
2. You will not be allowed to write during the first 15 minutes.
3. This time is to be spent in reading the question paper.
4. The time given at the head of this Paper is the time allowed for writing the answers.
5. Section A is compulsory. Attempt any four questions from Section B.
6. The intended marks for questions or parts of questions are given in brackets [].

SECTION-A (40 Marks) (Attempt all questions from this Section.)

Q1. Choose the correct answers to the questions from the given options. (Do not copy the questions, write the correct answers only.)

1.1. The unsaturated hydrocarbons undergo _____.

1. A substitution reaction
2. An oxidation reaction
3. An addition reaction
4. None of the above
5. Redox reaction

Solution

The unsaturated hydrocarbons undergo an addition reaction.

Explanation:

Because double and triple bonds in unsaturated hydrocarbons are broken down into single bonds, they are subject to addition reactions.

1.2. In the 2nd period Neon has maximum Ionization Potential because _____.

1. It has unstable electronic configuration.
2. It easily accepts electrons.
3. It easily loses electrons.
4. The outer most shell is completely filled.

Solution

In the 2nd period Neon has maximum Ionization Potential because the outer most shell is completely filled.

Explanation:

Neon's valence shell is completely filled, making it extremely stable and requiring more energy to remove an electron, giving it the highest ionisation potential in the second period.

1.3. Copper, zinc, and Tin are the metals alloyed to form _____.

1. Duralumin
2. Brass
3. Bronze
4. Solder

Solution

Copper, zinc, and Tin are the metals alloyed to form bronze.

Explanation:

Duralumin consists of 90% Al and 4% Cu, while bronze is an alloy with 80% Cu, 4% Zn, and 16% Sn. Cu and Zn combine to form brass. Pb and Sn are alloyed using solder.

1.4. The metal hydroxide which reacts with both acids and alkalis to form salt and water is _____.

1. Calcium hydroxide

2. Magnesium hydroxide

3. Aluminium hydroxide

4. Ferric hydroxide

Solution

The metal hydroxide which reacts with both acids and alkalis to form salt and water is aluminium hydroxide.

Explanation:

Because Al (OH)₃ is amphoteric in nature, it can generate salt and water as well as behave as a base with a strong acid.

1.5. Reaction of an alcohol with a carboxylic acid in the presence of concentrated H₂SO₄ is termed as _____.

1. Halogenation

2. Esterification

3. Hydrogenation

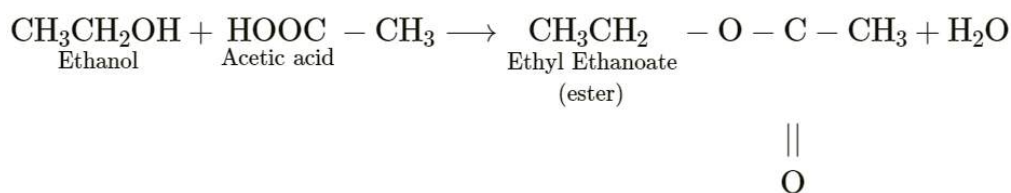
4. Dehydrohalogenation

Solution

Reaction of an alcohol with a carboxylic acid in the presence of concentrated H₂SO₄ is termed as esterification.

Explanation:

The process that produces an ester when an alcohol reacts with carboxylic acid in the presence of H₂SO₄ is known as an esterification reaction.



1.6. Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of _____.

1. Dehydration

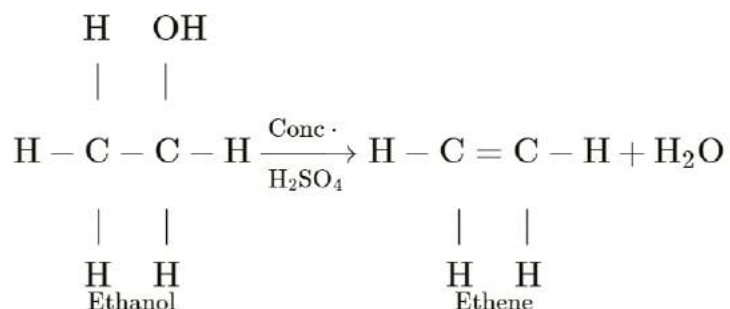
2. Dehydrogenation
3. Dehydrohalogenation
4. Hydrolysis

Solution

Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of dehydration.

Explanation:

Conc. H_2SO_4 is a useful dehydrator since it turns alcohol into an alkene by removing the water molecule.



1.7. The oxidizing agent in the equation $\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$ is _____.

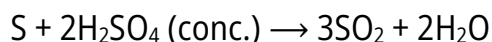
1. Sulphur
2. Sulphuric acid
3. Sulphur dioxide
4. Water

Solution

The oxidizing agent in the equation $\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$ is sulphuric acid.

Explanation:

The reaction is as follows:



The oxidizing agent in this process is concentrated H_2SO_4 . While being converted to SO_2 , it oxidizes sulphur (S) to produce sulphur dioxide SO_2 .

1.8. Electron Affinity is maximum in _____.

1. Mg
2. Ar
3. Li
4. Br

Solution

Electron Affinity is maximum in Br.

Explanation:

From left to right in the periodic table, electron affinity generally increases because atoms become more prone or unstable to gaining an electron in order to achieve a stable electronic configuration, such as that of noble gases. Because they need one electron to complete their octet, halogens such as bromine (Br) have an excessively high electron affinity. Metals like magnesium (Mg) and lithium (Li) have lesser propensities to lose electrons than noble gases like argon (Ar), which have entire outer shells.

1.9. The compound that is not a constituent of the electrolytic mixture used in Hall-Heroult's process is _____.

1. Al_2O_3
2. NaAlO_2
3. Na_3AlF_6
4. CaF_2

Solution

The compound that is not a constituent of the electrolytic mixture used in Hall-Heroult's process is NaAlO_2 .

Explanation:

Aluminum from aluminum oxide is extracted using the Hall-Heroult technique (alumina, Al_2O_3). In order to lower the melting point of alumina and increase the conductivity of the solution, an electrolytic mixture made primarily of molten

alumina, a mixture of cryolite (Na_3AlF_6), and additional fluxes such as calcium fluoride (CaF_2) is employed in this process.

1.10. On passing ammonia gas over heated copper oxide for some time, a reddish-brown residue is left behind. What property of ammonia is demonstrated here?

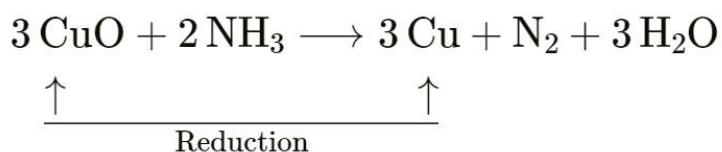
1. Basic property
2. Oxidising property
3. Reducing property
4. Acidic property

Solution

Reducing property

Explanation:

CuO functions as a reducing agent because it is reduced to Cu (reddish brown ppt.) in the presence of ammonia.



1.11. Rotten egg smell is due to the liberation of _____.

1. HCl gas
2. H_2S gas
3. Cl_2 gas
4. SO_2 gas

Solution

Rotten egg smell is due to the liberation of H_2S gas.

Explanation:

Hydrogen sulfide (H_2S) release is frequently the cause of the stench of rotting eggs. Hydrogen sulphide is a colorless gas with a foul odour reminiscent of rotten eggs. As they break down organic waste, microorganisms naturally create it.

1.12. Ammonia gas is collected by downward displacement of air since ammonia is _____.

1. Very slightly soluble in water
2. Heavier than air
3. Lighter than air
4. Insoluble in water

Solution

Ammonia gas is collected by downward displacement of air since ammonia is lighter than air.

Explanation:

Ammonia gas is collected in an inverted gas jar by displacing air downward due to its lighter density. Ammonia is very soluble and cannot be collected over water.

1.13. Which of the following would occupy 22.4 litres at S.T.P.?

1. 32 g of oxygen gas
2. 2 moles of hydrogen gas
3. 6.022×10^{23} molecules of ammonia

[Atomic weights: O = 16, H = 1, N = 14]

1. 1 and 2
2. 1 and 3
3. 2 and 3
4. 1, 2 and 3

Solution

1 and 3

Explanation:

Gram molecular = 1 mole

= 6.022×10^{23} molecules

= 22.4 L

∴ Molecular Mass of O₂ gas = 32 g

= 6.022×10^{23} molecules

= 22.4 L

Similarly, 6.022×10^{23} molecule of NH₃ = 22.4 L

Since 1 mole of any gas occupies 22.4 litres at STP, 2 moles of hydrogen gas would occupy $2 \times 22.4 = 44.8$ litres, which is more than 22.4 litres.

1.14. In the molecule of water, oxygen atom has _____.

1. One shared pair of electrons
2. Three shared pairs of electrons
3. Two lone pairs of electrons
4. One lone pair of electrons

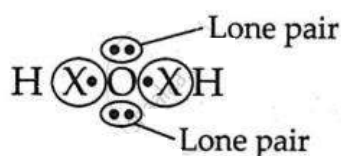
Solution

In the molecule of water, oxygen atom has two lone pairs of electrons.

Explanation:

A water molecule has 2H atoms and 1O atom. O has an electrical configuration of 2, 6 and requires 2 electrons to complete its octet.

∴ it shares 2e⁻ with 2H-atoms



1.15. A mineral from which the metal can be extracted economically and conveniently is known as _____.

1. Matrix
2. Ore
3. Flux
4. Alloy

Solution

A mineral from which the metal can be extracted economically and conveniently is known as ore.

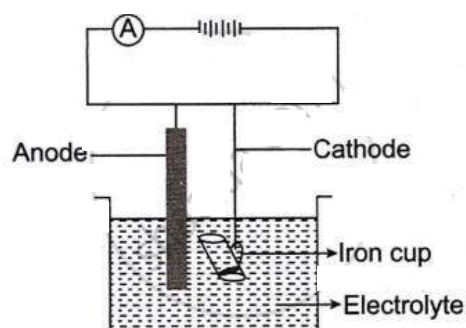
Explanation:

An ore is a mineral that allows for profitable metal extraction.

Q2.

2.1. The following sketch represents the electroplating of an Iron cup with Nickel metal.

Study the diagram and answer the following questions:



- During electroplating, the iron cup is placed at the cathode. Why?
- Name the ion that must be present in the electrolyte.
- State one condition that is necessary to ensure that the deposit is smooth, firm and even.
- Write the reaction taking place at the cathode.
- What change would you observe at the anode?

Solution

- In electroplating, the iron cup is put at the cathode because the cathode is a negative terminal that attracts metals that are positively charged. This leads to the reduction and formation of metal ions.
- The electrolyte used is a water-based solution of NiSO_4 , so the ions formed are Ni^{2+} , H^+ , SO_4^{2-} , OH^- .
- To ensure smooth deposition, current should be passed slowly and over a longer period of time.

d. Cathode: $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$ (Reduction)

e. The anode, a Ni plate, is etched after the Ni ions finish in the electrolyte.

2.2. Match the Column A with Column B.

Column A		Column B	
(a)	Water	1.	Lithium
(b)	Alkali metal	2.	Iodine
(c)	Halogen	3.	Covalent compound
(d)	Calcium oxide	4.	Acetic acid
(e)	Weak acid	5.	Ionic compound
		6.	Sulphuric acid

Solution

Column A		Column B	
(a)	Water	3.	Covalent compound
(b)	Alkali metal	1.	Lithium
(c)	Halogen	2.	Iodine
(d)	Calcium oxide	5.	Ionic compound
(e)	Weak acid	4.	Acetic acid

2.3. Complete the following sentences by choosing the correct answer from the brackets:

2.3. (a) The salt prepared by the method of direct combination is _____.

1. Iron (II) chloride (FeCl_2)

2. Iron (III) chloride (FeCl_3)

Solution

The salt prepared by the method of direct combination is Iron (III) chloride (FeCl_3).

2.3. (b) The metallic oxide which can be reduced by using common reducing agents is _____.

1. Fe_2O_3

2. Al_2O_3

Solution

The metallic oxide which can be reduced by using common reducing agents is Fe_2O_3 .

2.3. (c) The metal nitrate which on thermal decomposition forms a black residue is _____.

1. zinc nitrate

2. copper nitrate

Solution

The metal nitrate which on thermal decomposition forms a black residue is copper nitrate.

2.3. (d) During the electrolysis of copper sulphate solution, if _____ is used as electrodes, the colour of the electrolyte does not fade.

1. copper

2. platinum

Solution

During the electrolysis of copper sulphate solution, if copper is used as electrodes, the colour of the electrolyte does not fade.

2.3. (e) The process of heating the concentrated ore in a limited supply or absence of air is _____.

1. Roasting

2. Calcination

Solution

The process of heating the concentrated ore in a limited supply or absence of air is calcination.

2.4. (a) State the term for the following:

The group obtained by removing one hydrogen atom from the parent alkane.

Solution

Alkyl group

2.4. (b) State the term for the following:

Two metal plates or wires through which the current enters and leaves the electrolytic cell.

Solution

Electrodes

2.4. (c) State the term for the following:

The amount of substance which contains the same number of units as the number of atoms in carbon-12.

Solution

Mole

2.4. (d) State the term for the following:

The tendency of an atom to pull a shared pair of electrons towards itself in a compound.

Solution

Electronegativity

2.4. (e) State the term for the following:

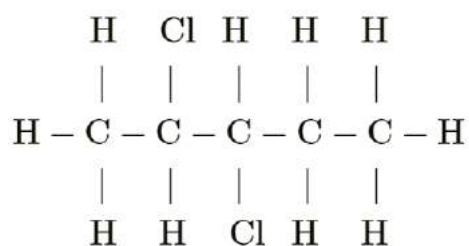
The formula which represents the simplest ratio between the atoms of elements present in a compound.

Solution

Empirical formula

2.5. (a)

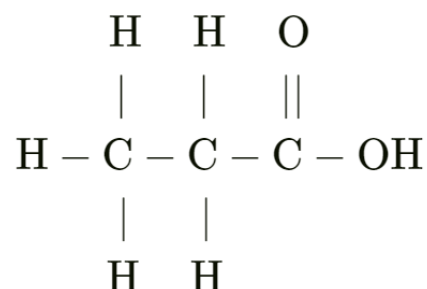
1. Give the IUPAC name of the organic compound represented by the structural formula given below:



Solution

The IUPAC name of the given organic compound is 2, 3-Dichloropentane.

2. Give the IUPAC name of the organic compound represented by the structural formula given below:



Solution

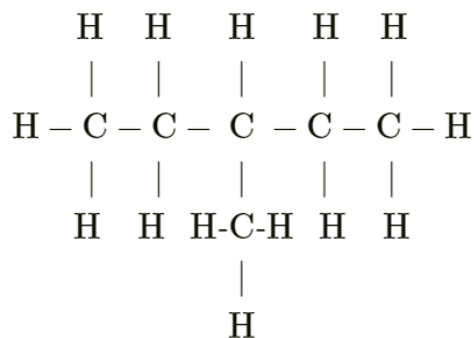
The IUPAC name of the given organic compound is propan-1-oic acid.

2.5. (b)

1. Draw the structural diagram for the following organic compound:

3-methyl pentane

Solution

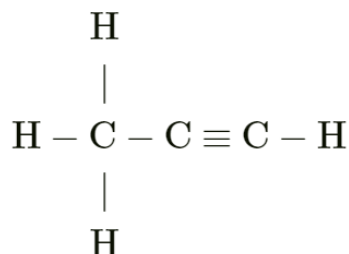


2. Write the structural formula of propyne.

Draw the structural diagram for the following organic compound:

Solution

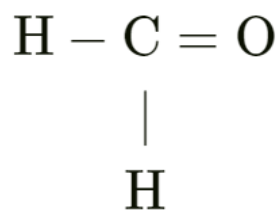
The structural formula of propyne is as follows:



3. Give the structural formula of the following organic compound:

Methanal

Solution



SECTION-B (40 Marks) (Attempt any four questions from this Section.)

Q3.

3.1. (a) Rewrite the following statement by adding the correct word, as shown in the example:

Example:

Given Statement: Ammonia changes moist red litmus to blue.

Correct Statement: Aqueous ammonia changes moist red litmus to blue.

Sulphuric acid acts as a dehydrating agent.

Solution

Concentrated sulphuric acid acts as a dehydrating agent.

Explanation:

Conc. H_2SO_4 has a strong affinity for water and so reduces it from the molecule, whereas dilute acid dissolves in water.

3.1. (b) Rewrite the following statement by adding the correct word, as shown in the example:

Example:

Given Statement: Ammonia changes moist red litmus to blue.

Correct Statement: Aqueous ammonia changes moist red litmus to blue.

Ammonia reacts with chlorine to give ammonium chloride and nitrogen.

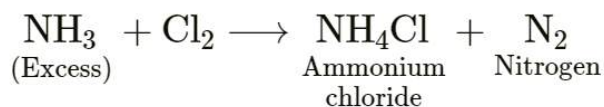
Solution

Excess ammonia reacts with chlorine to give ammonium chloride and nitrogen.

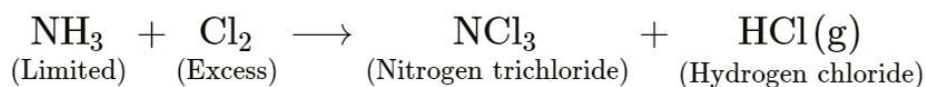
Explanation:

Ammonia reacts in two ways:

1. If ammonia is in excess,



2. If ammonia is in limited supply,



3.2. (a) Identify only the anion present in the following compound:

The compound, on heating, produces a colourless, odourless gas which turns lime water milky and has no effect on acidified potassium dichromate solution.

Solution

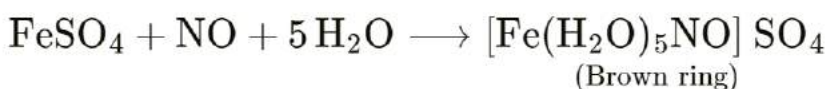
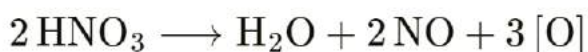
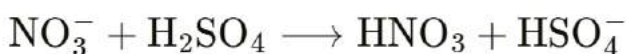
The anion present is carbonate CO_3^{2-} . Heating the appropriate component causes CO_2 to be released, turning lime water milky and not affecting acidified potassium dichromate solutions.

3.2. (b) Identify only the anion present in the following compound:

The solution of the compound which on treating with concentrated sulphuric acid and freshly prepared ferrous sulphate solution produces a brown ring.

Solution

The anion present is nitrate NO_3^- . The nitrate-containing chemical undergoes the following reactions to generate a brown ring.



3.3. (a) Mohan has three solutions P, Q and R having a pH of 13, 5 and 2 respectively. Which of the above solutions P, Q or R will react with magnesium to liberate hydrogen gas?

Solution

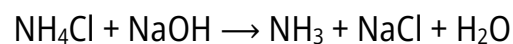
Highly acidic with pH-2, 'R' interacts with metal to create salt and release H_2 gas.



3.3. (b) Mohan has three solutions P, Q and R having a pH of 13, 5 and 2 respectively. Which of the above solutions P, Q or R will liberate ammonia gas when it reacts with ammonium chloride?

Solution

'P' reacts with ammonium chloride to produce ammonia due to the fact that it is highly basic at pH-13.



3.3. (c) Mohan has three solutions P, Q and R having a pH of 13, 5 and 2 respectively. Which of the above solutions P, Q or R will contain molecules as well as ions?

Solution

With a pH of 5, 'Q' is a weak acid. Because it is partially dissociated, it contains both molecules and ions, making it unionised.

3.4. The following table is related to an industrial process of an acid.

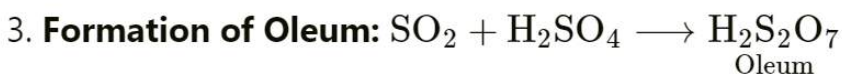
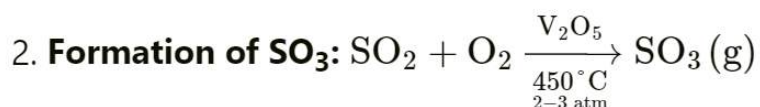
Name of the process	Reactant	Catalyst	Final product
(a)	$\text{SO}_2 + \text{O}_2$	(b)	(c)

Identify (a), (b) and (c).

Solution

Name of the process	Reactant	Catalyst	Final product
(a) Contact process	$\text{SO}_2 + \text{O}_2$	(b) Vanadium oxide	(c) Sulphuric acid

The contact process is an industrial method used to produce sulphuric acid through a sequence of reactions.



Formation of Sulphuric acid



Q4.

4.1. (a) Define the term.

Molar volume

Solution

One mole of any gaseous molecules occupies 22.4 dm^3 (litre) or 22400 cm^3 (ml) at standard temperature and pressure (STP). This volume is known as the molar volume.

"The molar volume of a gas can be defined as the volume occupied by one mole of a gas at standard temperature and pressure."

4.1. (b) Define normal salt.

Solution

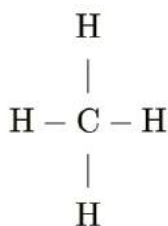
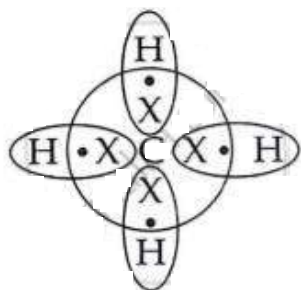
Normal salts are the salts formed by the complete replacement of the ionizable hydrogen atoms of an acid by a metallic or ammonium ion. For example: Sodium chloride (NaCl).

4.2. (a) Draw the electron dot structure of Methane molecule.

[Atomic number: N = 7, C = 6, H = 1]

Solution

Methane: CH_4 , C = 2, 4 H = 1

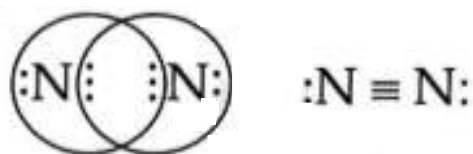


4.2. (b) Draw the electron dot structure of Nitrogen molecule.

[Atomic number: N = 7, C = 6, H = 1]

Solution

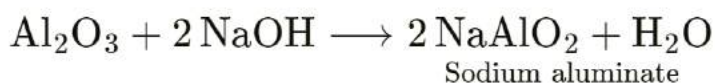
Nitrogen: N_2 , N = 2, 5



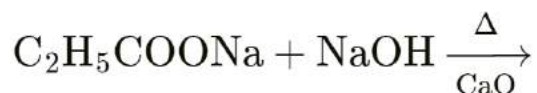
4.3. (a) Complete and balance the following equation:



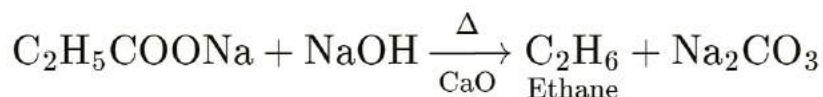
Solution



4.3. (b) Complete and balance the following equation:



Solution



4.3. (c) Complete and balance the following equation:



Solution



4.4. Choose the organic compound from the list given below to answer the following questions:

4.4. (a) The compound which does not have a double bond in its structure.

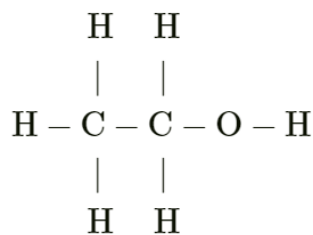
1. Ethene
2. Ethanoic acid
3. Ethanol
4. Methanal

Solution

Ethanol

Explanation:

The structural formula clearly represents all single bonds.



4.4. (b) The compound in its pure form turns into an ice like solid on cooling.

1. Ethene
2. Ethanoic acid
3. Ethanol
4. Methanal

Solution

Ethanoic acid

Explanation:

Melting point of ethanoic acid is 289.5 K, or 16°C. It so freezes below this temperature and is also known as glacial acetic acid.

4.4. (c) The compound which is used for artificial ripening of fruits.

1. Ethene
2. Ethanoic acid
3. Ethanol
4. Methanal

Solution

Ethene

Explanation:

Fruits start their ripening process with gaseous ethylene emissions. So, a chemical called ethephon (2-chloroethyl phosphonic acid) is also used to make fruits ripen faster. This chemical gets inside the fruit and breaks down into ethylene calcium carbide.

Q5.

5.1. (a) Name the main constituent metal in the following alloy:

Duralumin

Name the main metal used in making the alloy given below:

Duralumin

Solution

Aluminium

Explanation:

Duralumin is actually a composition with 95% Al, 4% Copper, 0.5% Mg and 0.5% Mn.

5.1. (b) Name the main constituent metal in the following alloy:

Stainless steel

Name the main metal used in making of the alloy given below:

Stainless steel

Solution

Iron

Explanation:

Iron and carbon make up most of stainless steel, in minor amounts. Therefore, steel is just stainless steel with a 10% Ni and a 15% Cr addition.

Stainless steel

- Fe (73%)
- Cr (18%)
- Ni (8%)
- C (1%)

5.2. (a) Differentiate between the following pairs based on the odourless gas which turns lime water milky and the criteria given:

Sulphuric acid and Nitric acid (using barium chloride solution)

Solution

Sulphuric Acid	Nitric Acid
When sulphuric acid reacts with barium chloride, a white ppt. of barium sulphate is formed. $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$	Barium chloride does not react with nitric acid.

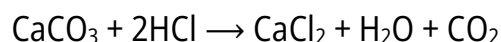
5.2. (b) Differentiate between the following pairs based on the criteria given:

Unsaturated and Saturated hydrocarbons (type of bond present)

Solution

Unsaturated Hydrocarbon	Saturated Hydrocarbon
Unsaturated hydrocarbons are those where carbon atoms self-catenate through double and triple bonds (σ and π bonds).	Saturated hydrocarbons are those where carbon atoms self catenate through a single bond (σ bond).
E.g. $\begin{array}{c} \text{H} - \text{C} = \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{H} \\ \text{C} \equiv \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	E.g. $\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$

5.3. (a) Calcium carbonate react with dilute hydrochloric acid as given below:



What is the mass of 5 moles of calcium carbonate? (Relative molecular mass of calcium carbonate is 100)

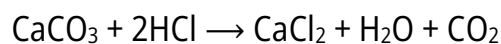
Solution

1 mole of $\text{CaCO}_3 = 100 \text{ g}$

5 moles of $\text{CaCO}_3 \rightarrow 5 \times 100 = 500 \text{ g}$

Hence, the mass of 5 moles of CaCO_3 will be 500 g

5.3. (b) Calcium carbonate react with dilute hydrochloric acid as given below:



How many moles of HCl will react with 5 moles of calcium carbonate?

Solution

2 moles of HCl are used for 1 mole of CaCO_3

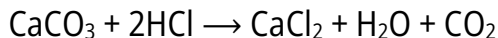
i.e., $\text{CaCO}_3 \quad \text{HCl}$

1mole \rightarrow 2 mole

5mole $\rightarrow 5 \times 2 = 10$ moles

Hence 10 moles of HCl will react with 5 moles of calcium carbonate.

5.3. (c) Calcium carbonate react with dilute hydrochloric acid as given below:



What is the volume of carbon dioxide liberated at S.T.P. at the same time?

Solution

100 g of $\text{CaCO}_3 \rightarrow 22.4$ l of CO_2

$$500 \text{ g of } \text{CaCO}_3 = \frac{22.4 \times 500}{100}$$

= 112.0

\therefore 112.0 of CO_2

Hence, 112 l of CO_2 is liberated from 5 moles of calcium carbonate.

5.4. (a) Identify the gas evolved in the following reaction:

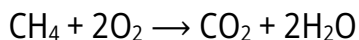
Methane undergoes complete combustion.

Solution

Carbon dioxide

Explanation:

Methane burns completely to produce carbon dioxide and water.



5.4. (b) Identify the gas evolved in the following reaction:

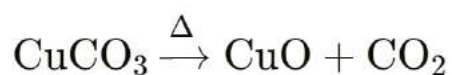
Copper carbonate is heated.

Solution

Carbon dioxide

Explanation:

On heating, green copper carbonate breaks down to produce black copper oxide and releases CO₂.



5.4. (c) Identify the gas evolved in the following reaction:

MnO₂ reacts with concentrated HCl.

Solution

Chlorine

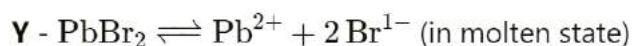
Explanation:

Manganese oxide reacts with cone. HCl, releasing greenish colored chlorine and forming manganese chloride.



Q6.

6.1. (a)

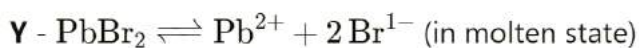


From the above reaction X or Y, identify the reaction which exhibit:
electrolytic dissociation

Solution

'Y' Electrolytic dissociation of PbBr₂ occurs when energy in the form of heat induces molecules to generate ions, breaking the electrostatic interaction between ions.

6.1. (b)



From the above reaction X or Y, identify the reaction which exhibit:
Ionization

Solution

'X' HCl is a powerful acid; therefore, in solution, it completely dissociates and generates independent ions that are not held together by any force.

6.2. (a) Give a reason for Inert gases do not form ions.

Solution

Inert gases do not produce ions because their outermost shell is completely filled, resulting in a stable electronic state. As a result, atoms cannot absorb or lose electrons in order to create ions.

6.2. (b) Give reason for the following:

Covalent compounds have a low melting and boiling point.

Solution

Covalent compounds are held together by modest intramolecular forces. As a result, breaking the bonds between two or more molecules requires only a minimal amount of energy.

Therefore, these compounds have low melting and boiling points.

6.3. (a) Arrange the following as per the instruction given in the bracket:

Carbon, Fluorine, Beryllium (decreasing order of atomic size).

Solution

Beryllium > Carbon > Fluorine

Explanation:

As we proceed along a period, the size of the atom decreases due to increased nuclear pull.

6.3. (b) Arrange the following as per the instruction given in the bracket:

Sulphuric acid, Phosphoric acid, Acetic acid (increasing order of number of replaceable H atoms per molecule).

Solution

Acetic acid < sulphuric acid < phosphoric acid.

Explanation:

Acetic acid is CH_3COOH when it ionizes, it has only one H^+ ion ($\text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COO}^- + \text{H}^+$). While sulphuric has 2 replaceable Hydrogen atoms ($\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$). Phosphoric acid is H_3PO_4 which ionises to give 3-H atoms ($\text{H}_3\text{PO}_4 = 3\text{H}^+ + \text{PO}_4^{3-}$).

6.3. (c) Arrange the following as per the instruction given in the bracket:

Potassium, Lithium, Sodium (increasing order of ionization potential).

Solution

Lithium < Sodium < Potassium.

Explanation:

Li's electrical configuration 2, 1 will result in least ionization potential. Atomic number 11 for sodium corresponds to 2, 8, 1. With an atomic number of 19, potassium exhibits electrical configuration as 2, 8, 8, 1. This indicates that the atomic radii change from Li to Na to K and from shell count. As size grows, nuclear attraction reduces and the distance from nucleus rises; so, electron can readily exit with great energy. Greater and smaller the atom's size will be the nuclear pull.

6.4. (a) Identify the following:

An element in Period 1 which can be placed in both Group 1 and Group 17 of the Periodic Table.

Solution

Hydrogen

Explanation:

Hydrogen has an electronic configuration of 1, which allows it to take e^- and complete its duplet as halogen (Group 17), as well as donate 1 e^- as alkali metals (Group 1).

6.4. (b) Identify the following:

The element having electronic configuration 2, 8, 6.

Solution

Sulphur

Explanation:

The atomic number of S is 16. The electronic arrangements are 2, 8, 6.

6.4. (c) Identify the following:

The most electronegative element of Period 3.

Solution

Chlorine

Explanation:

Electronegativity grows from left to right during a certain duration.

Q7.

7.1. Rita was given an unknown salt for identification. She prepared a solution of the salt and divided it into two parts.

- To the first part of the salt solution, she added a few drops of ammonium hydroxide and obtained a reddish-brown precipitate.
- To the second part of the salt solution, she added a few drops of silver nitrate solution and obtained a white precipitate.

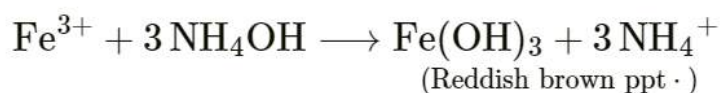
Name:

- a. The cation present and
- b. The anion present in the salt given for identification.

Solution

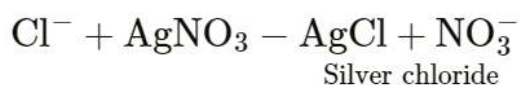
a. Cation Fe^{3+} (ferric ion)

When Fe^{3+} reacts with NH_4OH it forms ferric hydroxide.



b. Anion: Cl^- (Chloride ion)

When Cl^- reacts with silver nitrate, it forms a white ppt. of silver chloride.



7.2. Fill in the blanks by choosing the correct answer from the bracket:

7.2. (a) Carbon tetrachloride is a _____ covalent molecule.

1. Polar
2. Non-polar

Solution

Carbon tetrachloride is a non-polar covalent molecule.

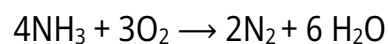
7.2. (b) During electrolysis of acidulated water, the gas liberated at the anode is _____.

1. Oxygen
2. Hydrogen

Solution

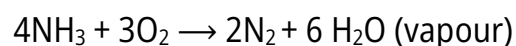
During electrolysis of acidulated water, the gas liberated at the anode is oxygen.

7.3. Ammonia burns in oxygen, as shown below.



If 240 cc of ammonia is burnt in 300 cc of oxygen, find out the composition of the resultant gaseous mixture at room temperature.

Solution



By Gay Lussac's Law

For N_2 :

4 vol. of NH_3 results 2 vol. of N_2

$$240 \text{ cc of } \text{NH}_3 \text{ will result} = \frac{2 \times 240}{4}$$

$$= 120 \text{ cc of } \text{N}_2$$

For H_2O (vapour phase):

4 Vol. of NH_3 results 6 vol. of H_2O

$$240 \text{ cc of } \text{NH}_3 \text{ will result} = \frac{240 \times 6}{4}$$

= 360 cc of H₂O

For O₂:

4 vol. of NH₃ reacts with 3 vol. of H₂O

240 cc of NH₃ will react with = $\frac{3 \times 240}{4}$

= 180 cc of O₂

7.4. The following table shows the electronic configuration of the atoms A, B, C and D.

Element	A	B	C	D
Electronic configuration	2, 8, 8, 2	2, 6	2, 8, 7	2, 4

a. Write the formula of the compound formed between:

1. A and B

2. D and C

b. Which of the above elements will exhibit catenation?

Solution

(a) (1)

	Electronic Configuration	Valency
A:	2, 8, 8, 2	+ 2
B:	2, 6	- 2

Formula: AB

(2)

	Electronic Configuration	Valency
D:	2, 4	± 4
C:	2, 8, 7	- 1

Formula: DC₄

(b) 'D' will exhibit catenation.

Q8.

8.1. Choose the correct answer from the list given below:

8.1. (a) The ore which can be concentrated by magnetic separation.

1. Zinc blende
2. C_2H_2
3. Calamine
4. CH
5. Haematite

Solution

Haematite

Explanation:

Haematite, an iron ore, is magnetically attractive.

8.1. (b) Empirical formula of Ethyne.

1. Zinc blende
2. C_2H_2
3. Calamine
4. CH
5. Haematite

Solution

CH

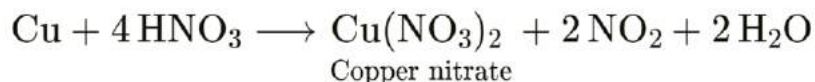
Explanation:

C_2H_2 is a molecular formula that represents the simple ratio in which atoms are joined; consequently, the empirical formula is CH.

8.2. (a) Give a balanced equation for the following reaction:

Copper reacts with concentrated nitric acid.

Solution



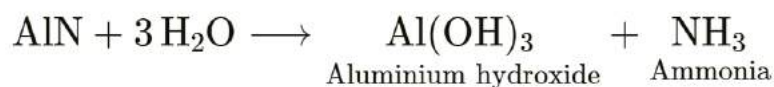
8.2. (b) Write the equation for the reaction:

Aluminum, Nitride and Water.

Give balanced equation for the following reaction:

Aluminium nitride is treated with warm water

Solution



8.3. Match the salts underlined in Column A with the most suitable method of preparation given in Column B.

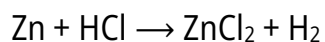
Column A	Column B
(a) from <u>ZnCl₂</u> from Zn	1. Precipitation
(b) from <u>KNO₃</u> from KOH.	2. Direct combination
(c) from <u>CaCO₃</u> from CaCl ₂ .	3. Displacement reaction
	4. Neutralization

Solution

Column A	Column B
(a) from <u>ZnCl₂</u> from Zn	3. Displacement reaction
(b) from <u>KNO₃</u> from KOH.	4. Neutralization
(c) from <u>CaCO₃</u> from CaCl ₂ .	1. Precipitation

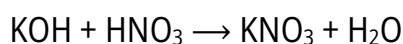
Explanation:

a. Displacement Reaction



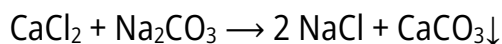
Displace H from HCl because zinc is more reactive than hydrogen.

b. Neutralization Reaction



Base + Acid \rightarrow Salt + water; Neutralization reaction

c. Precipitation Reaction

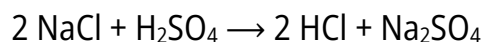


Sodium chloride and a calcium carbonate precipitate follow from the double displacement reaction.

8.4. (a) Hydrogen chloride gas is prepared in the laboratory by the action of concentrated sulphuric acid on sodium chloride.

Give a balanced chemical equation for the above reaction.

Solution



Sodium's greater reactivity than hydrogen replaces 'H' from acid to produce matching salts and strong volatile acid (HCl).

8.4. (b) Hydrogen chloride gas is prepared in the laboratory by the action of concentrated sulphuric acid on sodium chloride.

State the method of collection of the gas formed above.

Solution

Upward displacement of water.

8.4. (c) Hydrogen chloride gas is prepared in the laboratory by the action of concentrated sulphuric acid on sodium chloride.

What is the property of sulphuric acid that makes it a suitable reagent for the reaction?

Solution

Sulphuric acid's low volatility and high boiling point qualify it as a suitable reagent for this reaction.